AR TARGET SHEET

The following document was too large to scan as one unit, therefore, it has been divided into sections.

EDMC#:	0073124
SECTION:	3 OF 3
DOCUMENT #:	Letter: 07-AMRC-0224 Document: DOE/RL-2007-21 Draft A
TITLE:	Risk Assessment Report for 100 Area and 300 Area Component of River Corridor Baseline Risk Assessment (RCBRA)

Table 5-17. Chronic Oral Slope Factors for Inorganic Chemicals. (2 Pages)

Chemical	Oral CSF (mg/kg-day)$^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
Uranium							Route covered by Tier 1 (IRIS) oral RfD
Vanadium							Route covered by Tier 1 (IRIS) oral RfD
Zinc							Route covered by Tier 1 (IRIS) oral RfD

Table 5-18. Chronic Oral Slope Factors for Organic Chemicals.

Chemical	Oral CSF (mg/kg-day)$^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
1,1,2,2-Tetrachloroethane	2.00E-01	mouse	hepatocellular carcinoma	linearized multistage procedure, extra risk	C	IRIS, 2007	Tier 1 (IRIS)
1,2-Dichloroethane	9.10E-02	rat	hemangiosarcomas	linearized multistage procedure with time-to-death analysis, extra risk	B2	IRIS, 2007	Tier 1 (IRIS)
1,4-Dichlorobenzene							Tier 3 (HEAST) oral SF not used because the oral route is covered by a Tier 1 (IRIS) route extrapolation of an inhalation RfD, in which there is more confidence than the Tier 3 (HEAST) oral SF.
1-Butanol							Route is covered by Tier 1 (IRIS) oral RfD

Table 5-18. Chronic Oral Slope Factors for Organic Chemicals.

Chemical	Oral CSF (mg/kg-day)$^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
2-(2,4,5-Trichlorophenoxy)propionic acid							Route is covered by Tier 1 (IRIS) oral RfD
2,4,5-Trichlorophenoxyacetic acid							Route is covered by Tier 1 (IRIS) oral RfD
2,4-Dichlorophenoxyacetic acid							Route is covered by Tier 1 (IRIS) oral RfD
2-Butanone							Route is covered by Tier 1 (IRIS) oral RfD
2-Butoxyethanol							Route is covered by Tier 1 (IRIS) oral RfD
2-Methylnaphthalene							Route is covered by Tier 1 (IRIS) oral RfD
2-secButyl-4,6-dinitrophenol(DNBP)							Route is covered by Tier 1 (IRIS) oral RfD
3+4 Methylphenol (cresol, m+p)							Route is covered by Tier 1 (IRIS) oral RfD for surrogate; 3-methlyphenol
4-(2,4-Dichlorophenoxy)butanoic acid							Route is covered by Tier 1 (IRIS) oral RfD
Acenaphthene							Route is covered by Tier 1 (IRIS) oral RfD
Acenaphthylene							Route is covered by Tier 1 (IRIS) oral RfD for surrogate; acenaphthene
Acetone							Route is covered by Tier 1 (IRIS) oral RfD
Aldrin	1.70E+01	mouse	liver carcinoma	linearized multistage procedure, extra risk	B2	IRIS, 2007	Tier 1 (IRIS)

Table 5-18. Chronic Oral Slope Factors for Organic Chemicals.

Chemical	Oral CSF (mg/kg-day)$^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
Alpha-BHC	6.30E+00	mouse	hepatic nodules and hepatocellular carcinomas	linearized multistage procedure, extra risk	B2	IRIS, 2007	Tier 1 (IRIS)
Anthracene							Route is covered by Tier 1 (IRIS) oral RfD
Aroclor 1242	2.00E+00	rat	liver hepatocellular adenomas, carcinomas, cholangiomas, or cholangiocarcinomas; PCBs	Linear extrapolation below LED10s; High risk and persistence; upper-bound slope factor	B2	IRIS, 2007	Tier 1 (IRIS) surrogate; total PCBs, aroclor 1242 is a PCB congener
Aroclor 1248	2.00E+00	rat	see aroclor 1242	see aroclor 1242	B2	IRIS, 2007	Tier 1 (IRIS) surrogate; total PCBs, aroclor 1248 is a PCB congener
Aroclor 1254	2.00E+00	rat	see aroclor 1242	see aroclor 1242	B2	IRIS, 2007	Tier 1 (IRIS) surrogate; total PCBs, aroclor 1254 is a PCB congener
Aroclor 1260	2.00E+00	rat	see aroclor 1242	see aroclor 1242	B2	IRIS, 2007	Tier 1 (IRIS) surrogate; total PCBs, aroclor 1260 is a PCB congener
Aroclor 1262	2.00E+00	rat	see aroclor 1242	see aroclor 1242	B2	IRIS, 2007	Tier 1 (IRIS) surrogate; total PCBs, aroclor 1262 is a PCB congener
Benzene	1.50E-02	human	leukemia	Linear extrapolation of human occupational data	A	IRIS, 2007	Tier 1 (IRIS)

Table 5-18. Chronic Oral Slope Factors for Organic Chemicals.

Chemical	Oral CSF (mg/kg-day)$^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
Benzo(a)anthracene	7.30E-01					EPA Region 6 HHMSSLs, 2007	Tier 3 (NCEA)
Benzo(a)pyrene	7.30E+00	mouse/ rat	forestomach, squamous cell papillomas and carcinomas; forestomach, larynx and esophagus, papillomas and carcinomas (combined)	risk estimate based on a geometric mean of four slope factors obtained by different modeling procedures	B2	IRIS, 2007	Tier 1 (IRIS)
Benzo(b)fluoranthene	7.30E-01				B2	EPA Region 6 HHMSSLs, 2007	Tier 3 (NCEA)
Benzo(ghi)perylene							Route is covered by Tier 1 (IRIS) oral RfD for surrogate; pyrene
Benzo(k)fluoranthene	7.30E-02				B2	EPA Region 6 HHMSSLs, 2007	Tier 3 (NCEA)
beta-1,2,3,4,5,6-Hexachlorocyclohexane	1.80E+00	mouse	hepatic nodules and hepatocellular carcinoma	linearized multistage procedure, extra risk	C	IRIS, 2007	Tier 1 (IRIS)
Bis(2-ethylhexyl) phthalate	1.40E-02	mouse		linearized multistage procedure, extra risk	B2	IRIS, 2007	Tier 1 (IRIS)

Table 5-18. Chronic Oral Slope Factors for Organic Chemicals.

Chemical	Oral CSF (mg/kg-day)$^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
Butylbenzylphthalate							Route is covered by Tier 1 (IRIS) oral RfD
Carbazole	2.00E-02					EPA Region 6 HHMSSLs, 2007	Tier 3 (HEAST)
Carbon disulfide							Route is covered by Tier 1 (IRIS) oral RfD
Carbon tetrachloride	1.30E-01	hamster/ Syrian	Hepatocellular carcinomas/ hepatomas	Linearized multistage procedure, extra risk	B2	IRIS, 2007	Tier 1 (IRIS)
Chlordane	3.50E-01	mouse	hepatocellular carcinoma	linearized multistage procedure, extra risk; chlordane (technical)	B2	IRIS, 2007	Tier 1 (IRIS)
Chloroform	8.05E-02					IRIS, 2007	Tier 1 (IRIS) route extrapolation
Chrysene	7.30E-03				B2	EPA Region 6 HHMSSLs, 2007	Tier 3 (NCEA)
cis-1,2-Dichloroethene							Route is covered by Tier 2 (PPRTV) oral RfD
Dalapon							Route is covered by Tier 1 (IRIS) oral RfD
Delta-BHC	6.30E+00					IRIS, 2007	Tier 1 (IRIS) surrogate; alpha-BHC

Table 5-18. Chronic Oral Slope Factors for Organic Chemicals.

Chemical	Oral CSF (mg/kg-day)$^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
Dibenz[a,h]anthracene	7.30E+00				B2	EPA Region 6 HHMSSLs, 2007	Tier 3 (NCEA)
Dibenzofuran							Route is covered by Tier 3 (NCEA) oral RfD
Dicamba							Route is covered by Tier 1 (IRIS) oral RfD
Dichlorodiphenyldichloroethane	2.40E-01	mouse	liver tumors	linearized multistage procedure, extra risk	B2	IRIS, 2007	Tier 1 (IRIS)
Dichlorodiphenyldichloroethylene	3.40E-01	mouse	hepatocellular carcinomas, hepatomas	linearized multistage procedure, extra risk	B2	IRIS, 2007	Tier 1 (IRIS)
Dichlorodiphenyltrichloroethane	3.40E-01	mouse/rat	liver tumors, benign and malignant	linearized multistage procedure, extra risk	B2	IRIS, 2007	Tier 1 (IRIS)
Dichloroprop							Route is covered by Tier 1 (IRIS) oral RfD for surrogate 4-(2,4-dichlorophenoxy)butanoic acid
Dieldrin	1.60E+01	mouse	liver carcinoma	linearized multistage procedure, extra risk	B2	IRIS, 2007	Tier 1 (IRIS)
Diethyl ether							Route is covered by Tier 1 (IRIS) oral RfD

Table 5-18. Chronic Oral Slope Factors for Organic Chemicals.

Chemical	Oral CSF (mg/kg-day)$^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
Diethylphthalate							Route is covered by Tier 1 (IRIS) oral RfD
Di-n-butylphthalate							Route is covered by Tier 1 (IRIS) oral RfD
Di-n-octylphthalate							Route is covered by Tier 2 (PROV) oral RfD
Endosulfan I							Route is covered by Tier 1 (IRIS) oral RfD for surrogate endosulfan
Endosulfan II							Route is covered by Tier 1 (IRIS) oral RfD for surrogate endosulfan
Endosulfan sulfate							Route is covered by Tier 1 (IRIS) oral RfD for surrogate endosulfan
Endrin							Route is covered by Tier 1 (IRIS) oral RfD
Endrin aldehyde							Route is covered by Tier 1 (IRIS) oral RfD for surrogate endrin
Endrin ketone							Route is covered by Tier 1 (IRIS) oral RfD for surrogate endrin
Ethylene glycol							Route is covered by Tier 1 (IRIS) oral RfD
Fluoranthene							Route is covered by Tier 1 (IRIS) oral RfD
Fluorene							Route is covered by Tier 1 (IRIS) oral RfD

Table 5-18. Chronic Oral Slope Factors for Organic Chemicals.

Chemical	Oral CSF (mg/kg-day)$^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
Heptachlor	4.50E+00	mouse	hepatocellular carcinomas	linearized multistage procedure, extra risk	B2	IRIS, 2007	Tier 1 (IRIS)
Heptachlor epoxide	9.10E+00	mouse	hepatocellular carcinomas	linearized multistage procedure, extra risk	B2	IRIS, 2007	Tier 1 (IRIS)
Indeno(1,2,3-cd)pyrene	7.30E-01				B2	EPA Region 6 HHMSSLs	Tier 3 (NCEA)
Isophorone	9.50E-04	rat	preputial gland carcinoma	linearized multistage procedure, extra risk	C	IRIS, 2007	Tier 1 (IRIS)
Methoxychlor							Route is covered by Tier 1 (IRIS) oral RfD
Methyl isobutyl ketone							Route is covered by Tier 1 (IRIS) route extrapolated oral RfD
Methylenechloride	7.50E-03	mouse	hepatocellular adenomas or carcinomas (NTP) and hepatocellular cancer and neoplastic nodules (NCA)	linearized multistage procedure, extra risk	B2	IRIS, 2007	Tier 1 (IRIS)
Naphthalene							Route is covered by Tier 1 (IRIS) oral RfD

Table 5-18. Chronic Oral Slope Factors for Organic Chemicals.

Chemical	Oral CSF (mg/kg-day)$^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
Pentachlorophenol	1.20E-01	mouse	hepatocellular adenoma/carcinoma, pheochromocytoma/ malignant pheochromocytoma, hemangiosarcoma/ hemangioma (pooled incidence)	linearized multistage procedure	B2	IRIS, 2007	Tier 1 (IRIS)
Phenanthrene							Route is covered by Tier 1 (IRIS) oral RfD for surrogate pyrene
Phenol							Route is covered by Tier 1 (IRIS) oral RfD
Picloram							Route is covered by Tier 1 (IRIS) oral RfD
Pyrene							Route is covered by Tier 1 (IRIS) oral RfD
Tetrachloroethene							Tier 3 (NCEA) oral SF not used because oral route covered by Tier 1 (IRIS) oral RfD.
Toluene							Route is covered by Tier 1 (IRIS) oral RfD
Trichloroethene	4.00E-01					EPA Region 6 HHMSSLs, 2007	Tier 3 (NCEA)
Trichloromonofluoromethane							Route is covered by Tier 1 (IRIS) oral RfD

Table 5-19. Chronic Inhalation Slope Factors for Inorganic Chemicals.

Chemical	Unit Risk $(\mu g/m^3)^{-1}$	Inh. CSF $(mg/kg\text{-}day)^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
Aluminum								Route covered by Tier 2 (PPRTV) inhalation RfD.
Antimony								No Data
Arsenic	0.0043	15.1	human	lung cancer	absolute risk, linear model	A	IRIS, 2007	Tier 1 (IRIS)
Barium								Route covered by Tier 3 (HEAST) inhalation RfD.
Beryllium	0.0024	8.4	human	lung cancer	relative risk	B1	IRIS, 2007	Tier 1 (IRIS)
Boron								Route covered by Tier 3 (HEAST) inhalation RfD.
Cadmium	0.0018	6.3	human	lung, trachea, bronchus cancer deaths	two stage; only first affected by exposure; extra risk	B1	IRIS, 2007	Tier 1 (IRIS)
Chromium								No Data
Hexavalent Chromium	0.012	42	human	lung cancer	multi-stage, extra risk	A	IRIS, 2007	Tier 1 (IRIS)
Cobalt	0.0028	9.8				B1	EPA Region 6 HHMSSLs, 2007	Tier 2 (PPRTV)
Copper								No Data
Fluoride								No Data
Lead								See Section 5.5.8
Manganese								Route covered by Tier 1 (IRIS) inhalation RfD
Mercury								Route covered by Tier 1 (IRIS) inhalation RfD
Molybdenum								No Data
Nickel								No Data

Table 5-19. Chronic Inhalation Slope Factors for Inorganic Chemicals.

Chemical	Unit Risk $(\mu g/m^3)^{-1}$	Inh. CSF $(mg/kg\text{-}day)^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
Nitrogen in Nitrate								No Data
Nitrogen in Nitrite								No Data
Selenium								No Data
Silver								No Data
Strontium (elemental)								No Data
Thallium								No Data
Uranium								No Data
Vanadium								No Data
Zinc								No Data

Table 5-20. Chronic Inhalation Slope Factors for Organic Chemicals.

Chemical	Unit Risk $(\mu g/m^3)^{-1}$	Inh. CSF $(mg/kg\text{-}day)^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
1,1,2,2-Tetrachloroethane	5.80E-05	2.03E-01	mouse	hepatocellular carcinoma	linearized multistage procedure, extra risk	C	IRIS, 2007	Tier 1 (IRIS)
1,2-Dichloroethane	2.60E-05	9.10E-02	rat	hemangiosarcomas	linearized multistage procedure, extra risk	B2	IRIS, 2007	Tier 1 (IRIS)
1,4-Dichlorobenzene								Tier 3 (NCEA) inhalation SF not used because inhalation route covered by Tier 1 (IRIS) inhalation RfD
1-Butanol								Route is covered by Tier 1 (IRIS) route extrapolation
2-(2,4,5-Trichlorophenoxy)propionic acid								Route is covered by Tier 1 (IRIS) route extrapolation
2,4,5-Trichlorophenoxyacetic acid								Route is covered by Tier 1 (IRIS) route extrapolation

Table 5-20. Chronic Inhalation Slope Factors for Organic Chemicals.

Chemical	Unit Risk $(\mu g/m^3)^{-1}$	Inh. CSF $(mg/kg\text{-}day)^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
2,4-Dichlorophenoxyacetic acid								Route is covered by Tier 1 (IRIS) route extrapolation
2-Butanone								Route is covered by Tier 1 (IRIS) inhalation RfD
2-Butoxyethanol								Route is covered by Tier 1 (IRIS) inhalation RfD
2-Methylnaphthalene								Route is covered by Tier 1 (IRIS) route extrapolation
2-secButyl-4,6-dinitrophenol(DNBP)								Route is covered by Tier 1 (IRIS) route extrapolation
3+4 Methylphenol (cresol, m+p)								Route is covered by Tier 1 (IRIS) route extrapolation of 3-methylphenol
4-(2,4-Dichlorophenoxy)butanoic acid								Route is covered by Tier 1 (IRIS) route extrapolation
Acenaphthene								Route is covered by Tier 1 (IRIS) inhalation RfD

Table 5-20. Chronic Inhalation Slope Factors for Organic Chemicals.

Chemical	Unit Risk $(\mu g/m^3)^{-1}$	Inh. CSF $(mg/kg\text{-}day)^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
Acenaphthylene								Route is covered by Tier 1 (IRIS) route extrapolation of surrogate acenaphthene
Acetone								Route is covered by Tier 1 (IRIS) route extrapolation
Aldrin	4.90E-03	1.72E+01	mouse	liver carcinoma	Linearized multistage procedure, extra risk	B2	IRIS, 2007	Tier 1 (IRIS)
Alpha-BHC	1.80E-03	6.30E+00	mouse	hepatic nodules and hepatocellular carcinomas	linearized multistage procedure, extra risk	B2	IRIS, 2007	Tier 1 (IRIS)
Anthracene								Route is covered by Tier 1 (IRIS) route extrapolation
Aroclor 1242	1.00E-04	3.50E-01	rat	liver hepatocellular adenomas, carcinomas, cholangiomas, or cholangiocarcinomas; PCBs	linear extrapolation below LED10s	B2	IRIS, 2007	Tier 1 (IRIS) surrogate; total PCBs, aroclor 1242 is a PCB congener

Table 5-20. Chronic Inhalation Slope Factors for Organic Chemicals.

Chemical	Unit Risk (µg/m^3)$^{-1}$	Inh. CSF (mg/kg-day)$^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
Aroclor 1248	1.00E-04	3.50E-01	rat	see aroclor 1242	see aroclor 1242	B2	IRIS, 2007	Tier 1 (IRIS) surrogate; total PCBs, aroclor 1248 is a PCB congener
Aroclor 1254	1.00E-04	3.50E-01	rat	see aroclor 1242	see aroclor 1242	B2	IRIS, 2007	Tier 1 (IRIS) surrogate; total PCBs, aroclor 1254 is a PCB congener
Aroclor 1260	1.00E-04	3.50E-01	rat	see aroclor 1242	see aroclor 1242	B2	IRIS, 2007	Tier 1 (IRIS) surrogate; total PCBs, aroclor 1260 is a PCB congener
Aroclor 1262	1.00E-04	3.50E-01	rat	see aroclor 1242	see aroclor 1242	B2	IRIS, 2007	Tier 1 (IRIS) surrogate; total PCBs, aroclor 1262 is a PCB congener
Benzene	2.20E-06	7.70E-03	human	leukemia	low-dose linearity utilizing maximum likelihood estimates	A	IRIS, 2007	Tier 1 (IRIS)
Benzo(a)anthracene		3.10E-01					EPA Region 6 HHMSSLs, 2007	Tier 3 (NCEA)

Table 5-20. Chronic Inhalation Slope Factors for Organic Chemicals.

Chemical	Unit Risk (µg/m³)⁻¹	Inh. CSF (mg/kg-day)⁻¹	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
Benzo(a)pyrene		3.10E+00				B2	EPA Region 6 HHMSSLs, 2007	More confidence is placed in the Tier 3 (NCEA) inhalation SF than in route extrapolation from the Tier 1 (IRIS) oral SF
Benzo(b)fluoranthene		3.10E-01				B2	EPA Region 6 HHMSSLs, 2007	Tier 3 (NCEA)
Benzo(ghi)perylene								Route is covered by Tier 1 (IRIS) route extrapolation of surrogate; pyrene
Benzo(k)fluoranthene		3.10E-02				B2	EPA Region 6 HHMSSLs, 2007	Tier 3 (NCEA)
beta-1,2,3,4,5,6-Hexachlorocyclohexane	5.30E-04	1.86E+00	mouse	hepatic nodules and hepatocellular carcinomas	linearized multistage procedure, extra risk	C	IRIS, 2007	Tier 1 (IRIS)
Bis(2-ethylhexyl) phthalate		1.40E-02					IRIS, 2007	Tier 1 (IRIS) route extrapolation
Butylbenzylphthalate								Route is covered by Tier 1 (IRIS) route extrapolation

Table 5-20. Chronic Inhalation Slope Factors for Organic Chemicals.

Chemical	Unit Risk (µg/m^3)$^{-1}$	Inh. CSF (mg/kg-day)$^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
Carbazole		2.00E-02					EPA Region 6 HHMSSLs, 2007	Tier 3 (HEAST) route extrapolation
Carbon disulfide								Route is covered by Tier 1 (IRIS) inhalation RfD
Carbon tetrachloride	1.50E-05	5.25E-02	hamster, Syrian	hepatocellular carcinomas/ hepatomas	Linearized multistage procedure, extra risk	B2	IRIS, 2007	Tier 1 (IRIS)
Chlordane	1.00E-04	3.50E-01	mouse	hepatocellular carcinoma; chlordane (technical)	linearized multistage procedure, extra risk	B2	IRIS, 2007	Tier 1 (IRIS)
Chloroform	2.30E-05	8.05E-02	mouse	hepatocellular carcinoma	linearized multistage procedure, extra risk	B2	IRIS, 2007	Tier 1 (IRIS)
Chrysene		3.10E-03				B2	EPA Region 6 HHMSSLs, 2007	Tier 3 (NCEA)
cis-1,2-Dichloroethene								Route is covered by Tier 2 (PPRTV) route extrapolation
Dalapon								Route is covered by Tier 1 (IRIS) route extrapolation

Table 5-20. Chronic Inhalation Slope Factors for Organic Chemicals.

Chemical	Unit Risk $(\mu g/m^3)^{-1}$	Inh. CSF $(mg/kg\text{-}day)^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
Delta-BHC		6.30E+00					IRIS, 2007	Tier 1 (IRIS) route extrapolation
Dibenz[a,h]anthracene	8.80E-01	3.10E+00				B2	EPA Region 6 HHMSSLs, 2007	Tier 3 (NCEA)
Dibenzofuran								Route is covered by Tier 3 (NCEA) route extrapolation
Dicamba								Route is covered by Tier 1 (IRIS) route extrapolation
Dichlorodiphenyldichloroethane		2.40E-01					IRIS, 2007	Tier 1 (IRIS) route extrapolation
Dichlorodiphenyldichloroethylene		3.40E-01					IRIS, 2007	Tier 1 (IRIS) route extrapolation
Dichlorodiphenyltrichloroethane	9.70E-05	3.40E-01	mouse/ rat	liver tumors, benign and malignant	linear multistage procedure, extra risk		IRIS, 2007	Tier 1 (IRIS)
Dichloroprop								Route is covered by Tier 1 (IRIS) route extrapolation
Dieldrin	4.60E-03	1.61E+01	mouse	liver carcinoma	linearized multistage procedure		IRIS, 2007	Tier 1 (IRIS)

Table 5-20. Chronic Inhalation Slope Factors for Organic Chemicals.

Chemical	Unit Risk $(\mu g/m^3)^{-1}$	Inh. CSF $(mg/kg\text{-}day)^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
Diethyl ether								Route is covered by Tier 1 (IRIS) route extrapolation
Diethylphthalate								Route is covered by Tier 1 (IRIS) route extrapolation
Di-n-butylphthalate								Route is covered by Tier 1 (IRIS) route extrapolation
Di-n-octylphthalate								Route is covered by Tier 2 (PROV) route extrapolation
Endosulfan I								Route is covered by Tier 1 (IRIS) route extrapolation for surrogate endosulfan I
Endosulfan II								Route is covered by Tier 1 (IRIS) route extrapolation for surrogate endosulfan I

Table 5-20. Chronic Inhalation Slope Factors for Organic Chemicals.

Chemical	Unit Risk $(\mu g/m^3)^{-1}$	Inh. CSF $(mg/kg\text{-}day)^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
Endosulfan sulfate								Route is covered by Tier 1 (IRIS) route extrapolation for surrogate endosulfan I
Endrin								Route is covered by Tier 1 (IRIS) route extrapolation
Endrin aldehyde								Route is covered by Tier 1 (IRIS) route extrapolation for surrogate endrin
Endrin ketone								Route is covered by Tier 1 (IRIS) route extrapolation for surrogate endrin
Ethylene glycol								Route is covered by Tier 1 (IRIS) route extrapolation
Fluoranthene								Route is covered by Tier 1 (IRIS) route extrapolation
Fluorene								Route is covered by Tier 1 (IRIS) route extrapolation

Table 5-20. Chronic Inhalation Slope Factors for Organic Chemicals.

Chemical	Unit Risk $(\mu g/m^3)^{-1}$	Inh. CSF $(mg/kg\text{-}day)^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
Heptachlor	1.30E-03	4.55E+00	mouse	hepatocellular carcinomas	linearized multistage procedure, extra risk	B2	IRIS, 2007	Tier 1 (IRIS)
Heptachlor epoxide	2.60E-03	9.10E+00	mouse	hepatocellular carcinomas	linearized multistage procedure, extra risk	B2	IRIS, 2007	Tier 1 (IRIS)
Indeno(1,2,3-cd)pyrene		3.10E-01				B2	EPA Region 6 HHMSSLs	Tier 3 (NCEA)
Isophorone		9.50E-04					IRIS, 2007	Tier 1 (IRIS) route extrapolation
Methoxychlor								Route covered by Tier 1 (IRIS) route extrapolation
Methyl isobutyl ketone								Route covered by Tier 1 (IRIS) inhalation RfD.
Methylenechloride	4.70E-07	1.65E-03	mouse	combined adenomas and carcinomas	linearized multistage procedure, extra risk	B2	IRIS, 2007	Tier 1 (IRIS)
Naphthalene								Route covered by Tier 1 (IRIS) inhalation RfD
Pentachlorophenol		1.20E-01					IRIS, 2007	Tier 1 (IRIS) route extrapolation

Table 5-20. Chronic Inhalation Slope Factors for Organic Chemicals.

Chemical	Unit Risk $(\mu g/m^3)^{-1}$	Inh. CSF $(mg/kg\text{-}day)^{-1}$	Species	Tumors Observed	Dose-Response Model	W.O.E class	Source	Notes
Phenanthrene								Route covered by Tier 1 (IRIS) route extrapolation for surrogate pyrene
Phenol								Route covered by Tier 1 (IRIS) route extrapolation
Picloram								Route covered by Tier 1 (IRIS) route extrapolation
Pyrene								Route covered by Tier 1 (IRIS) route extrapolation
Tetrachloroethene								Tier 3 (NCEA) inhalation SF not used because inhalation route covered by Tier 1 (IRIS) inhalation RfD.
Toluene								Route covered by Tier 1 (IRIS) inhalation RfD
Trichloroethene		4.00E-01					EPA Region 6 HHMSSLs, 2007	Tier 3 (NCEA)
Trichloromonofluoromethane								Route covered by Tier 1 (IRIS) route extrapolated inhalation RfD

Table 5-21. Radionuclide Cancer Slope Factors.

Radionuclide	SF Includes Progeny?	Half Life (yr)	Soil Ing SF (risk/pCi)	Food Ing SF (risk/pCi)	Water Ing SF (risk/pCi)	Inh SF (risk/pCi)	Ext SF (risk/yr per pCi/g)
Americium-241		4.32E+02	2.17E-10	1.34E-10	1.04E-10	2.81E-08	2.76E-08
Barium-133		1.07E+01	1.39E-11	9.44E-12	6.81E-12	1.16E-11	1.44E-06
Carbon-14		5.73E+03	2.79E-12	2.00E-12	1.55E-12	7.07E-12	7.83E-12
Cesium-137	yes	3.00E+01	4.33E-11	3.74E-11	3.04E-11	1.19E-10	2.55E-06
Cobalt-60		5.27E+00	4.03E-11	2.23E-11	1.57E-11	3.58E-11	1.24E-05
Europium-152		1.33E+01	1.62E-11	8.70E-12	6.07E-12	9.10E-11	5.30E-06
Europium-154		8.80E+00	2.85E-11	1.49E-11	1.03E-11	1.15E-10	5.83E-06
Europium-155		4.96E+00	5.40E-12	2.77E-12	1.90E-12	1.48E-11	1.24E-07
Nickel-63		9.60E+01	1.79E-12	9.51E-13	6.70E-13	1.64E-12	0.00E+00
Plutonium-238		8.77E+01	2.72E-10	1.69E-10	1.31E-10	3.36E-08	7.22E-11
Plutonium-239/240		2.41E+04	2.76E-10	1.74E-10	1.35E-10	3.33E-08	2.00E-10
Plutonium-241		1.44E+01	3.29E-12	2.28E-12	1.76E-12	3.34E-10	4.11E-12
Potassium-40		1.28E+09	6.18E-11	3.43E-11	2.47E-11	1.03E-11	7.97E-07
Radium-226	yes	1.60E+03	7.30E-10	5.15E-10	3.86E-10	1.16E-08	8.49E-06
Radium-228	yes	5.75E+00	2.29E-09	1.43E-09	1.04E-09	5.23E-09	4.53E-06
Strontium-90	yes	2.91E+01	1.44E-10	9.53E-11	7.40E-11	1.13E-10	1.96E-08
Technetium-99		2.13E+05	7.66E-12	4.00E-12	2.75E-12	1.41E-11	8.14E-11
Thorium-228	yes	1.91E+00	8.09E-10	4.22E-10	3.00E-10	1.43E-07	7.76E-06
Thorium-230		7.70E+04	2.02E-10	1.19E-10	9.10E-11	2.58E-08	8.19E-10
Thorium-232		1.41E+10	2.31E-10	1.33E-10	1.01E-10	4.33E-08	3.42E-10
Tritium		1.24E+01	2.2E-13	1.44E-13	1.12E-13	1.99E-13	0.00E+00
Uranium-233/234		2.45E+05	1.58E-10	9.55E-11	7.07E-11	1.14E-08	2.52E-10
Uranium-235	yes	7.04E+08	1.63E-10	9.76E-11	7.18E-11	1.01E-08	5.43E-07
Uranium-238	yes	4.47E+09	2.10E-10	1.21E-10	8.71E-11	9.35E-09	8.66E-08

Table 5-22. Radionuclide Dose Conversion Factors.

Radionuclide	DCF Includes Progeny?	Half Life (yr)	Ing DCF (mrem/pCi)	Inh DCF (mrem/pCi)	Ext DCF (mrem/yr per pCi/g)
Americium-241		4.32E+02	3.64E-03	4.44E-01	4.37E-02
Barium-133		1.07E+01	3.40E-06	7.81E-06	1.98E+00
Carbon-14		5.73E+03	2.09E-06	2.09E-06	1.34E-05
Cesium-137	yes	3.00E+01	5.00E-05	3.19E-05	3.41E+00
Cobalt-60		5.27E+00	2.69E-05	2.19E-04	1.62E+01
Europium-152		1.33E+01	6.48E-06	2.21E-04	7.01E+00
Europium-154		8.80E+00	9.55E-06	2.86E-04	7.68E+00
Europium-155		4.96E+00	1.53E-06	4.14E-05	1.82E-01
Nickel-63		9.60E+01	5.77E-07	6.29E-06	0.00E+00
Plutonium-238		8.77E+01	3.20E-03	3.92E-01	1.51E-04
Plutonium-239/240		2.41E+04	3.54E-03	4.29E-01	2.95E-04
Plutonium-241		1.44E+01	6.84E-05	8.25E-03	5.90E-06
Potassium-40		1.28E+09	1.86E-05	1.24E-05	1.04E+00
Radium-226	yes	1.60E+03	1.33E-03	8.60E-03	1.12E+01
Radium-228	yes	5.75E+00	1.44E-03	5.08E-03	5.98E+00
Strontium-90	yes	2.91E+01	1.53E-04	1.31E-03	2.46E-02
Technetium-99		2.13E+05	1.46E-06	8.33E-06	1.26E-04
Thorium-228	yes	1.91E+00	8.08E-04	3.45E-01	1.02E+01
Thorium-230		7.70E+04	5.48E-04	3.26E-01	1.21E-03
Thorium-232		1.41E+10	2.73E-03	1.64E+00	5.21E-04
Tritium		1.24E+01	6.40E-08	6.40E-08	0.00E+00
Uranium-233/234		2.45E+05	2.83E-04	1.32E-01	4.02E-04
Uranium-235	yes	7.04E+08	2.67E-04	1.23E-01	7.57E-01
Uranium-238	yes	4.47E+09	2.69E-04	1.18E-01	1.52E-01

Table 5-23. Waste Sites Included in the Human Health Risk Assessment.

Operational Area	Site Code	CVP document ID	Operational Area	Site Code	CVP Document ID
100-BC	100-B-11	WSRF 2004-003	100-F	100-F-23	CVP-2003-00011
100-BC	100-B-14:3	WSRF 2004-007	100-F	100-F-24	CVP-2003-00012
100-BC	100-B-14:5	WSRF 2004-009	100-F	100-F-25	CVP-2003-00010
100-BC	100-B-14:6	WSRF 2004-010	100-F	100-F-26:1	WSRF 2005-008
100-BC	100-B-14:7	WSRF 2004-011	100-F	100-F-26:2	WSRF 2005 005
100-BC	100-B-16	WSRF 2005-009	100-F	100-F-26:5	WSRF 2005-007
100-BC	100-B-5	CVP-2003-00014	100-F	100-F-26:7	WSRF 2005-010
100-BC	100-B-8:1	CVP-2003-00022	100-F	100-F-35	CVP-2002-00007
100-BC	100-B-8:2	CVP-2003-00019	100-F	100-F-37	WSRF 2001-095
100-BC	100-C-3	CVP-2003-00009	100-F	100-F-38	WSRF 2004-093
100-BC	100-C-9:3	WSRF 2004-014	100-F	100-F-4	CVP-2002-00001
100-BC	116-B-1	CVP-99-00012	100-F	100-F-7	WSRF 2004-124
100-BC	116-B-10	CVP-99-00010	100-F	100-F-9	WSRF 2004-125
100-BC	116-B-11	CVP-1999-00001	100-F	116-F-1	CVP-2002-00009
100-BC	116-B-12	CVP-99-00008	100-F	116-F-10	CVP-2003-00003
100-BC	116-B-13	CVP-99-00002	100-F	116-F-11	CVP-2001-00003
100-BC	116-B-14	CVP-99-00003	100-F	116-F-14	CVP-2001-00009
100-BC	116-B-15	WSRF-2003-052	100-F	116-F-2	CVP-2001-00005
100-BC	116-B-2	CVP-99-00015	100-F	116-F-3	CVP-2002-00008
100-BC	116-B-3	CVP-99-00013	100-F	116-F-4	CVP-2001-00006
100-BC	116-B-4	CVP-99-00014	100-F	116-F-5	CVP-2001-00007
100-BC	116-B-6A	CVP-99-00011	100-F	116-F-6	CVP-2002-00010
100-BC	116-B-6B	CVP-99-00017	100-F	116-F-7	WSRF 2004-128
100-BC	116-B-7	CVP-2002-00003	100-F	116-F-9	CVP-2001-00008
100-BC	116-B-9	CVP-99-00009	100-F	118-F-8:1	CVP-2003-00017
100-BC	116-C-1	CVP-09-00006	100-F	128-F-1	WSRF 2003-35
100-BC	116-C-2A	CVP-99-00019	100-F	1607-F2	CVP-2002-00005
100-BC	116-C-5	CVP-99-00004	100-F	1607-F6	CVP-2001-00010
100-BC	116-C-6	WSRF 2003-34	100-F	UPR-100-F-2	CVP-2001-00011
100-BC	118-B-10	CVP-2004-00004	100-H	100-H-17	CVP-2000-00031
100-BC	118-B-3	CVP-2005-00001	100-H	100-H-21	CVP-2000-00029
100-BC	118-B-4	CVP-2004-00002	100-H	100-H-24	CVP-2000-00030
100-BC	118-B-5	CVP-2004-00003	100-H	100-H-5	CVP-2000-00028
100-BC	118-B-9	WSRF 2004-004	100-H	116-H-1	CVP-2000-00026
100-BC	118-C-2	CVP-2004-0005	100-H	116-H-7	CVP-2000-00027

Table 5-23. Waste Sites Included in the Human Health Risk Assessment.

Operational Area	Site Code	CVP document ID	Operational Area	Site Code	CVP Document ID
100-BC	118-C-4	CVP-2003-00015	100-H	1607-H2	CVP-2000-00024
100-BC	128-B-2	WSRF 2005-038	100-H	1607-H4	CVP-2000-00025
100-BC	128-C-1	WSRF 2005-019	100-K	100-K-29	WSRF 2004-040
100-BC	1607-B10	CVP-2003-00007	100-K	100-K-30	WSRF 2003-036
100-BC	1607-B11	CVP-2003-00008	100-K	100-K-31	WSRF 2004-038
100-BC	1607-B7	CVP-2003-00004	100-K	100-K-32	WSRF 2004 039
100-BC	1607-B8	CVP-2003-00005	100-K	100-K-33	WSRF 2004-041
100-BC	1607-B9	CVP-2003-00006	100-K	100-K-55:1	CVP-2005-00006
100-BC	600-232	WSRF 2004-066	100-K	100-K-56:1	CVP-2005-00006
100-BC	600-233	WSRF-2005-041	100-K	116-K-1	CVP-2003-00024
100-D	100-D-12	CVP-2000-00016	100-K	116-K-2	CVP-2006-00001
100-D	100-D-20	CVP-98-00003	100-K	116-KE-4	CVP-2005-00002
100-D	100-D-21	CVP-98-00002	100-K	116-KE-5	CVP-2005-00006
100-D	100-D-22	CVP-1998-00001	100-K	116-KW-3	CVP-2004-00001
100-D	100-D-4	CVP-98-00004	100-K	116-KW-4	CVP-2005-00006
100-D	100-D-48:1	CVP-2000-00003	100-K	128-K-1	WSRF 2004-042
100-D	100-D-48:2	CVP-2000-00005	100-N	116-N-3	CVP-2002-00002
100-D	100-D-48:3	CVP-2000-00034	100-N	120-N-1	CVP-2001-00021
100-D	100-D-48:4	CVP-2000-00033	100-IU-2	600-128	WSRF 2003-39
100-D	100-D-49:2	CVP-2000-00005	100-IU-2	600-131	WSRF 2003-45
100-D	100-D-49:4	CVP-2003-00016	100-IU-2	600-132	WSRF 2003-040
100-D	100-D-52	CVP-2000-00018	100-IU-2	600-181	WSRF 2003-048
100-D	116-D-1A	CVP-2000-00010	100-IU-2	600-190	WSRF 2003-047
100-D	116-D-2	CVP-2000-00013	100-IU-2	628-1	WSRF 2003-46
100-D	116-D-4	CVP-2000-00008	100-IU-6	600-107	WSRF 2003-033
100-D	116-D-7	CVP-99-00007	100-IU-6	600-204	WSRF 2003-43
100-D	116-D-9	CVP-2000-00012	100-IU-6	600-23	CVP-2001-00020
100-D	116-DR-1&2	CVP-2000-00002	100-IU-6	600-235	WSRF 2001-091
100-D	116-DR-4	CVP-2000-00015	100-IU-6	JA JONES	CVP-2001-00019
100-D	116-DR-6	CVP-2000-00014	300	300 ASH PITS	BHI-01132
100-D	116-DR-7	CVP-2000-00019	300	300 VTS	CVP-2005-00009
100-D	116-DR-9	CVP-99-00006	300	300-10	BHI-01134
100-D	118-DR-2:2	CVP-2003-00016	300	300-18	CVP-2005-00004
100-D	122-DR-1:2	CVP-2000-00018	300	300-45	BHI-01136

Table 5-23. Waste Sites Included in the Human Health Risk Assessment.

Operational Area	Site Code	CVP document ID	Operational Area	Site Code	CVP Document ID
100-D	1607-D2:1	CVP-98-00005	300	300-49	CVP-2000-00020
100-D	1607-D2:3	CVP-2000-00004	300	300-50	CVP-2000-00021
100-D	1607-D2:4	CVP-99-00005	300	300-8	CVP-2005-00007
100-D	1607-D4	WSRF 2005-036	300	316-1	CVP-2003-00002
100-F	100-F-11	CVP-2002-00001	300	316-2	BHI-01298
100-F	100-F-12	WSRF 2004-126	300	316-5	BHI-01164
100-F	100-F-14	WSRF 2004-127	300	600-259	CVP-2005-00008
100-F	100-F-15	CVP-2002-00001	300	600-47	CVP-2005-00005
100-F	100-F-16	CVP-2002-00001	300	618-12	CVP-2006-00010
100-F	100-F-18	WSRF 2004-137	300	618-4	CVP-2003-000020
100-F	100-F-19:1	CVP-2001-00002	300	618-5	CVP-2003-000021
100-F	100-F-19:2	CVP-2001-00003	300	628-4	CVP-2003-00001
100-F	100-F-2	CVP-2001-00001			

Table 5-24. Summary of RME Results for the Human Health Risk Assessment. (2 Pages)

RME CANCER RISK						
Scenario	**Range of Waste Site Soil-Related Risks (a)**	**Operational Area (No Excavation) Soil-Related Risks**	**Reference Area Soil-Related Background Risks**	**Range of Operational Area Fish Ingestion Pathway Risks**	**Range of Groundwater Exposure Risks**	**Soil-Related Risks for Thorium, Radium, and Potassium Isotopes**
Rural Residential	2E-04 to 7E-03	3E-04	2E-04	3E-06 to >1E-02 (b	4E-06 to 6E-03	2E-03
CTUIR (local area only)	1E-03 to >1E-02	>1E-02	8E-03	7E-05 to >1E-02 (b)	1E-04 to >1E-02 (c)	6E-03
Resident Monument Worker	3E-05 to 3E-03	4E-05	3E-05	NA	4E-06 to 4E-03	3E-04
Industrial / Commercial	3E-06 to 2E-03	2E-05	1E-05	NA	NA	1E-04
Avid Angler	NA	2E-06 to 3E-05	4E-06	1E-05 to >1E-02 (b)	NA	4E-05
Avid Hunter	NA	1E-04	3E-05	NA	NA	4E-04
Casual User	NA	3E-06	3E-06	NA	NA	2E-05
RME RADIATION DOSE (mrem / year)						
Scenario	**Range of Waste Site Soil-Related Doses (a)**	**Operational Area (No Excavation) Soil-Related Doses**	**Reference Area Soil-Related Background Doses**	**Range of Fish Ingestion Pathway Doses**	**Range of Groundwater Exposure Doses**	**Soil-Related Doses for Thorium, Radium, and Potassium Isotopes**
Rural Residential	1.0 to 370	2.7	1.8	0.14 to 13	0.20 to 150	46
CTUIR (local area only)	2.4 to 620	5.4	4.8	1.4 to 130	0.70 to 840 (c)	75
Resident Monument Worker	1.3 to 150	2.3	1.5	NA	0.20 to 150	14
Industrial / Commercial	0.19 to 120	1.0	0.66	NA	NA	6.1
Avid Angler	NA	0.04 to 1.1	0.15	0.52 to 49	NA	1.7
Avid Hunter	NA	0.27	0.17	NA	NA	8.4
Casual User	NA	0.095	0.090	NA	NA	0.68

Table 5-24. Summary of RME Results for the Human Health Risk Assessment. (2 Pages)

RME HAZARD INDEX (higher of child or adult)					
Scenario	**Range of Waste Site Soil-Related HI**	**Operational Area (No Excavation) Soil-Related HI**	**Reference Area Soil-Related Background HI**	**Range of Fish Ingestion Pathway HI**	**Range of Groundwater Exposure HI**
Rural Residential	5 to 200 (a)	8	20 (d)	3000 to 11000 (b	0.06 to 500
CTUIR (local area only)	30 to 700 (a)	90	500 (d)	300 to 1100 (b)	0.5 to 600 (c)
Resident Monument Worker	0.09 to 0.7	0.2	0.2	NA	0.02 to 300
Industrial / Commercial	0.01 to 0.2	0.07	0.04	NA	NA
Avid Angler	NA	0.03 to 0.08	0.04	1200 to 4000 (b)	NA
Avid Hunter	NA	3	4	NA	NA
Casual User	NA	0.03	0.03	NA	NA

NA: Not applicable.

(a) Upper-end of range is commonly skewed by 3 to 10 sites with elevated results; most waste sites have values at least a factor of 10 below the upper-end value.
(b) Lower and/or higher end of range related to elevated detection limits for organic chemicals.
(c) Includes exposure via groundwater use in the sweat lodge.
(d) Related to an elevated UCL for thallium in reference area soil.

Table 5-25a. Rural Residential RME Total Cancer Risk Results.

Waste Site ID	RME Cancer Risk	Waste Site ID	RME Cancer Risk	Waste Site ID	RME Cancer Risk	Waste Site ID	RME Cancer Risk
316-5	7E-03	100-F-2	4E-04	100-D-48:1	3E-04	600-107	3E-04
316-2	3E-03	618-4	4E-04	100-F-15	3E-04	100-C-3	3E-04
300-10	2E-03	116-K-2	4E-04	100-F-4	3E-04	600-190	3E-04
116-F-14	2E-03	116-F-10	4E-04	100-F-11	3E-04	600-181	3E-04
316-1	9E-04	116-F-11	4E-04	116-F-7	3E-04	600-131	3E-04
100-F-35	8E-04	116-H-7	4E-04	618-5	3E-04	100-B-11	3E-04
100-F-37	8E-04	100-D-20	4E-04	118-C-2	3E-04	128-B-2	3E-04
118-B-3	8E-04	116-KE-4	4E-04	100-H-24	3E-04	116-KW-4	3E-04
116-B-11	6E-04	1607-B8	4E-04	300-8	3E-04	600-47	3E-04
118-F-8:1	6E-04	116-B-13	4E-04	118-C-4	3E-04	122-DR-1:2	3E-04
1607-H4	6E-04	1607-B11	4E-04	300-49	3E-04	300 VTS	3E-04
100-D-48:2	6E-04	116-N-3	4E-04	100-F-24	3E-04	100-F-26:5	3E-04
116-B-1	6E-04	116-F-3	4E-04	116-B-10	3E-04	100-B-16	3E-04
116-DR-1&2	5E-04	100-B-14:7	4E-04	100-K-33	3E-04	600-233	3E-04
118-B-10	5E-04	100-K-55:1	4E-04	628-4	3E-04	118-B-5	3E-04
100-B-14:6	5E-04	1607-D4	4E-04	100-F-23	3E-04	120-N-1	3E-04
116-B-14	5E-04	116-F-1	4E-04	100-C-9:3	3E-04	628-1	3E-04
116-C-6	5E-04	116-B-6A	4E-04	116-D-9	3E-04	100-B-14:5	3E-04
100-H-21	5E-04	100-F-25	4E-04	116-DR-4	3E-04	100-F-26:1	3E-04
116-C-2A	5E-04	116-F-2	4E-04	100-B-14:3	3E-04	100-K-30	3E-04
116-H-1	5E-04	100-D-52	4E-04	100-F-19:2	3E-04	100-K-32	3E-04
116-F-6	5E-04	600-235	4E-04	100-H-17	3E-04	100-F-38	3E-04
116-C-5	5E-04	118-B-4	4E-04	100-B-5	3E-04	116-F-4	3E-04
116-DR-9	5E-04	116-B-7	4E-04	100-B-8:1	3E-04	128-K-1	3E-04
100-K-56:1	5E-04	UPR-100-F-2	3E-04	1607-B9	3E-04	300-18	3E-04
618-12	5E-04	116-B-2	3E-04	116-B-6B	3E-04	100-K-31	3E-04
116-D-7	5E-04	600-23	3E-04	100-D-21	3E-04	100-F-26:7	3E-04
300-50	4E-04	100-D-4	3E-04	100-D-49:2	3E-04	600-132	3E-04
116-K-1	4E-04	116-DR-6	3E-04	116-D-2	3E-04	600-232	3E-04
116-DR-7	4E-04	100-B-8:2	3E-04	116-B-4	3E-04	100-K-29	3E-04
116-B-15	4E-04	100-D-48:3	3E-04	100-F-19:1	3E-04	600-128	3E-04
116-C-1	4E-04	1607-B10	3E-04	116-B-3	3E-04	100-F-12	2E-04
100-D-49:4	4E-04	100-H-5	3E-04	1607-D2:3	3E-04	100-F-7	2E-04
118-B-9	4E-04	128-C-1	3E-04	116-KE-5	3E-04	100-F-9	2E-04
1607-H2	4E-04	100-F-16	3E-04	600-204	3E-04	116-F-5	2E-04
1607-F2	4E-04	100-D-22	3E-04	116-B-9	3E-04	100-F-26:2	2E-04
118-DR-2:2	4E-04	JA JONES	3E-04	1607-D2:4	3E-04	128-F-1	2E-04
116-KW-3	4E-04	100-D-48:4	3E-04	116-B-12	3E-04	100-F-14	2E-04
116-D-1A	4E-04	1607-F6	3E-04	600-259	3E-04	100-F-18	2E-04
300 ASH PITS	4E-04	116-F-9	3E-04	1607-B7	3E-04	300-45	2E-04
116-D-4	4E-04	100-D-12	3E-04	1607-D2:1	3E-04		

Table 5-25b. Rural Residential CTE Total Cancer Risk Results.

Waste Site ID	CTE Cancer Risk	Waste Site ID	CTE Cancer Risk	Waste Site ID	CTE Cancer Risk	Waste Site ID	CTE Cancer Risk
316-5	1E-04	118-B-4	4E-05	116-F-9	4E-05	100-F-26:5	3E-05
316-2	1E-04	116-K-1	4E-05	100-K-33	4E-05	600-47	3E-05
100-F-37	1E-04	116-D-1A	4E-05	100-D-22	4E-05	100-H-5	3E-05
116-F-14	8E-05	128-C-1	4E-05	100-F-23	4E-05	100-B-11	3E-05
316-1	7E-05	116-F-3	4E-05	100-B-8:1	4E-05	600-190	3E-05
100-D-49:4	6E-05	UPR-100-F-2	4E-05	100-D-4	4E-05	628-1	3E-05
100-F-35	6E-05	618-5	4E-05	116-DR-7	4E-05	118-C-4	3E-05
116-C-5	6E-05	600-204	4E-05	1607-B10	4E-05	122-DR-1:2	3E-05
116-B-14	5E-05	116-H-7	4E-05	100-F-19:2	4E-05	100-B-14:6	3E-05
116-B-11	5E-05	100-F-2	4E-05	600-131	4E-05	600-107	3E-05
100-H-21	5E-05	300-8	4E-05	100-D-52	4E-05	300 ASH PITS	3E-05
116-F-11	5E-05	100-F-16	4E-05	116-B-6B	4E-05	300 VTS	3E-05
300-10	5E-05	JA JONES	4E-05	100-F-25	4E-05	600-132	3E-05
116-KW-3	5E-05	100-D-12	4E-05	100-F-24	4E-05	100-F-26:7	3E-05
100-K-56:1	5E-05	100-H-24	4E-05	116-D-4	4E-05	100-K-30	3E-05
116-B-15	5E-05	100-F-15	4E-05	1607-D2:3	4E-05	118-B-5	3E-05
618-12	5E-05	100-F-4	4E-05	116-DR-4	4E-05	600-232	3E-05
116-H-1	5E-05	100-F-11	4E-05	618-4	4E-05	600-128	3E-05
116-DR-1&2	4E-05	116-F-7	4E-05	1607-B7	4E-05	1607-D2:1	3E-05
116-DR-9	4E-05	116-C-2A	4E-05	118-B-9	4E-05	128-K-1	3E-05
116-K-2	4E-05	100-D-20	4E-05	300-49	4E-05	300-18	3E-05
118-F-8:1	4E-05	116-B-2	4E-05	100-F-19:1	4E-05	100-K-31	3E-05
116-C-6	4E-05	116-D-7	4E-05	100-D-49:2	4E-05	100-F-26:1	3E-05
1607-H4	4E-05	116-KE-5	4E-05	116-B-10	4E-05	100-K-32	3E-05
116-N-3	4E-05	1607-B11	4E-05	116-D-9	4E-05	100-F-12	3E-05
300-50	4E-05	100-C-9:3	4E-05	116-B-13	4E-05	116-F-4	3E-05
116-F-1	4E-05	100-B-14:3	4E-05	116-D-2	4E-05	100-B-14:5	3E-05
100-D-48:2	4E-05	118-C-2	4E-05	100-H-17	4E-05	120-N-1	3E-05
100-K-55:1	4E-05	1607-B8	4E-05	600-259	4E-05	100-F-38	3E-05
116-KE-4	4E-05	116-DR-6	4E-05	116-KW-4	4E-05	100-K-29	3E-05
100-B-14:7	4E-05	1607-F2	4E-05	1607-D2:4	4E-05	100-F-9	3E-05
116-B-1	4E-05	100-B-5	4E-05	116-B-3	4E-05	100-F-7	3E-05
116-F-2	4E-05	118-DR-2:2	4E-05	100-B-16	4E-05	100-F-26:2	2E-05
116-F-10	4E-05	100-D-48:4	4E-05	116-B-4	4E-05	128-F-1	2E-05
100-B-8:2	4E-05	1607-B9	4E-05	116-B-9	4E-05	100-F-18	2E-05
118-B-3	4E-05	600-235	4E-05	100-C-3	4E-05	600-233	2E-05
116-F-6	4E-05	100-D-48:3	4E-05	600-23	4E-05	100-F-14	2E-05
600-181	4E-05	100-D-48:1	4E-05	116-B-12	3E-05	116-F-5	2E-05
116-C-1	4E-05	118-B-10	4E-05	128-B-2	3E-05	1607-D4	2E-05
116-B-7	4E-05	116-B-6A	4E-05	628-4	3E-05	300-45	1E-05
1607-H2	4E-05	1607-F6	4E-05	100-D-21	3E-05		

Table 5-26a. Rural Residential RME ILCR Results.

Waste Site ID	RME ILCR	Waste Site ID	RME ILCR	Waste Site ID	RME ILCR	Waste Site ID	RME ILCR
316-5	7.E-03	100-F-2	2.E-04	100-D-48:1	2.E-04	600-107	1.E-04
316-2	2.E-03	618-4	2.E-04	100-F-15	2.E-04	100-C-3	1.E-04
300-10	2.E-03	116-K-2	2.E-04	100-F-4	2.E-04	600-190	1.E-04
116-F-14	2.E-03	116-F-10	2.E-04	100-F-11	2.E-04	600-181	1.E-04
316-1	7.E-04	116-F-11	2.E-04	116-F-7	2.E-04	600-131	1.E-04
100-F-35	6.E-04	116-H-7	2.E-04	618-5	2.E-04	100-B-11	1.E-04
100-F-37	6.E-04	100-D-20	2.E-04	118-C-2	2.E-04	128-B-2	1.E-04
118-B-3	6.E-04	116-KE-4	2.E-04	100-H-24	2.E-04	116-KW-4	1.E-04
116-B-11	5.E-04	1607-B8	2.E-04	300-8	2.E-04	600-47	1.E-04
118-F-8:1	5.E-04	116-B-13	2.E-04	118-C-4	2.E-04	122-DR-1:2	1.E-04
1607-H4	4.E-04	1607-B11	2.E-04	300-49	2.E-04	300 VTS	1.E-04
100-D-48:2	4.E-04	116-N-3	2.E-04	100-F-24	2.E-04	100-F-26:5	1.E-04
116-B-1	4.E-04	116-F-3	2.E-04	116-B-10	2.E-04	100-B-16	1.E-04
116-DR-1&2	4.E-04	100-B-14:7	2.E-04	100-K-33	2.E-04	600-233	1.E-04
118-B-10	4.E-04	100-K-55:1	2.E-04	628-4	2.E-04	118-B-5	1.E-04
100-B-14:6	3.E-04	1607-D4	2.E-04	100-F-23	2.E-04	120-N-1	1.E-04
116-B-14	3.E-04	116-F-1	2.E-04	100-C-9:3	1.E-04	628-1	1.E-04
116-C-6	3.E-04	116-B-6A	2.E-04	116-D-9	1.E-04	100-B-14:5	1.E-04
100-H-21	3.E-04	100-F-25	2.E-04	116-DR-4	1.E-04	100-F-26:1	1.E-04
116-C-2A	3.E-04	116-F-2	2.E-04	100-B-14:3	1.E-04	100-K-30	1.E-04
116-H-1	3.E-04	100-D-52	2.E-04	100-F-19:2	1.E-04	100-K-32	1.E-04
116-F-6	3.E-04	600-235	2.E-04	100-H-17	1.E-04	100-F-38	1.E-04
116-C-5	3.E-04	118-B-4	2.E-04	100-B-5	1.E-04	116-F-4	1.E-04
116-DR-9	3.E-04	116-B-7	2.E-04	100-B-8:1	1.E-04	128-K-1	1.E-04
100-K-56:1	3.E-04	UPR-100-F-2	2.E-04	1607-B9	1.E-04	300-18	9.E-05
618-12	3.E-04	116-B-2	2.E-04	116-B-6B	1.E-04	100-K-31	9.E-05
116-D-7	3.E-04	600-23	2.E-04	100-D-21	1.E-04	100-F-26:7	9.E-05
300-50	3.E-04	100-D-4	2.E-04	100-D-49:2	1.E-04	600-132	9.E-05
116-K-1	3.E-04	116-DR-6	2.E-04	116-D-2	1.E-04	600-232	8.E-05
116-DR-7	2.E-04	100-B-8:2	2.E-04	116-B-4	1.E-04	100-K-29	8.E-05
116-B-15	2.E-04	100-D-48:3	2.E-04	100-F-19:1	1.E-04	600-128	8.E-05
116-C-1	2.E-04	1607-B10	2.E-04	116-B-3	1.E-04	100-F-12	7.E-05
100-D-49:4	2.E-04	100-H-5	2.E-04	1607-D2:3	1.E-04	100-F-7	6.E-05
118-B-9	2.E-04	128-C-1	2.E-04	116-KE-5	1.E-04	100-F-9	6.E-05
1607-H2	2.E-04	100-F-16	2.E-04	600-204	1.E-04	116-F-5	5.E-05
1607-F2	2.E-04	100-D-22	2.E-04	116-B-9	1.E-04	100-F-26:2	4.E-05
118-DR-2:2	2.E-04	JA JONES	2.E-04	1607-D2:4	1.E-04	128-F-1	4.E-05
116-KW-3	2.E-04	100-D-48:4	2.E-04	116-B-12	1.E-04	100-F-14	3.E-05
116-D-1A	2.E-04	1607-F6	2.E-04	600-259	1.E-04	100-F-18	2.E-05
300 ASH PITS	2.E-04	116-F-9	2.E-04	1607-B7	1.E-04	300-45	0
116-D-4	2.E-04	100-D-12	2.E-04	1607-D2:1	1.E-04		

Table 5-26b. Rural Residential CTE ILCR Results.

Waste Site ID	CTE ILCR	Waste Site ID	CTE ILCR	Waste Site ID	CTE ILCR	Waste Site ID	CTE ILCR
316-5	1.E-04	118-B-4	1.E-05	116-F-9	9.E-06	100-F-26:5	7.E-06
316-2	8.E-05	116-K-1	1.E-05	100-K-33	9.E-06	600-47	7.E-06
100-F-37	8.E-05	116-D-1A	1.E-05	100-D-22	9.E-06	100-H-5	6.E-06
116-F-14	6.E-05	128-C-1	1.E-05	100-F-23	9.E-06	100-B-11	6.E-06
316-1	4.E-05	116-F-3	1.E-05	100-B-8:1	9.E-06	600-190	6.E-06
100-D-49:4	3.E-05	UPR-100-F-2	1.E-05	100-D-4	9.E-06	628-1	6.E-06
100-F-35	3.E-05	618-5	1.E-05	116-DR-7	9.E-06	118-C-4	5.E-06
116-C-5	3.E-05	600-204	1.E-05	1607-B10	9.E-06	122-DR-1:2	5.E-06
116-B-14	3.E-05	116-H-7	1.E-05	100-F-19:2	9.E-06	100-B-14:6	5.E-06
116-B-11	3.E-05	100-F-2	1.E-05	600-131	9.E-06	600-107	4.E-06
100-H-21	3.E-05	300-8	1.E-05	100-D-52	9.E-06	300 ASH PITS	4.E-06
116-F-11	2.E-05	100-F-16	1.E-05	116-B-6B	9.E-06	300 VTS	4.E-06
300-10	2.E-05	JA JONES	1.E-05	100-F-25	9.E-06	600-132	4.E-06
116-KW-3	2.E-05	100-D-12	1.E-05	100-F-24	8.E-06	100-F-26:7	4.E-06
100-K-56:1	2.E-05	100-H-24	1.E-05	116-D-4	8.E-06	100-K-30	4.E-06
116-B-15	2.E-05	100-F-15	1.E-05	1607-D2:3	8.E-06	118-B-5	4.E-06
618-12	2.E-05	100-F-4	1.E-05	116-DR-4	8.E-06	600-232	3.E-06
116-H-1	2.E-05	100-F-11	1.E-05	618-4	8.E-06	600-128	3.E-06
116-DR-1&2	2.E-05	116-F-7	1.E-05	1607-B7	8.E-06	1607-D2:1	3.E-06
116-DR-9	2.E-05	116-C-2A	1.E-05	118-B-9	8.E-06	128-K-1	3.E-06
116-K-2	2.E-05	100-D-20	1.E-05	300-49	8.E-06	300-18	3.E-06
118-F-8:1	1.E-05	116-B-2	1.E-05	100-F-19:1	8.E-06	100-K-31	3.E-06
116-C-6	1.E-05	116-D-7	1.E-05	100-D-49:2	8.E-06	100-F-26:1	2.E-06
1607-H4	1.E-05	116-KE-5	1.E-05	116-B-10	8.E-06	100-K-32	1.E-06
116-N-3	1.E-05	1607-B11	1.E-05	116-D-9	8.E-06	100-F-12	1.E-06
300-50	1.E-05	100-C-9:3	1.E-05	116-B-13	8.E-06	116-F-4	2.E-07
116-F-1	1.E-05	100-B-14:3	1.E-05	116-D-2	8.E-06	100-B-14:5	3.E-08
100-D-48:2	1.E-05	118-C-2	1.E-05	100-H-17	8.E-06	120-N-1	6.E-10
100-K-55:1	1.E-05	1607-B8	1.E-05	600-259	8.E-06	100-F-38	0
116-KE-4	1.E-05	116-DR-6	1.E-05	116-KW-4	8.E-06	100-K-29	0
100-B-14:7	1.E-05	1607-F2	1.E-05	1607-D2:4	8.E-06	100-F-9	0
116-B-1	1.E-05	100-B-5	1.E-05	116-B-3	8.E-06	100-F-7	0
116-F-2	1.E-05	118-DR-2:2	1.E-05	100-B-16	8.E-06	100-F-26:2	0
116-F-10	1.E-05	100-D-48:4	1.E-05	116-B-4	8.E-06	128-F-1	0
100-B-8:2	1.E-05	1607-B9	1.E-05	116-B-9	8.E-06	100-F-18	0
118-B-3	1.E-05	600-235	1.E-05	100-C-3	8.E-06	600-233	0
116-F-6	1.E-05	100-D-48:3	1.E-05	600-23	8.E-06	100-F-14	0
600-181	1.E-05	100-D-48:1	1.E-05	116-B-12	7.E-06	116-F-5	0
116-C-1	1.E-05	118-B-10	1.E-05	128-B-2	7.E-06	1607-D4	0
116-B-7	1.E-05	116-B-6A	1.E-05	628-4	7.E-06	300-45	0
1607-H2	1.E-05	1607-F6	9.E-06	100-D-21	7.E-06		

Table 5-27a. Rural Residential RME Total Radiation Dose Results.

Waste Site ID	RME Dose (mrem/yr)	Waste Site ID	RME Dose (mrem/yr)	Waste Site ID	RME Dose (mrem/yr)	Waste Site ID	RME Dose (mrem/yr)
316-5	4E+02	116-KE-4	4E+00	100-F-15	3E+00	100-B-5	2E+00
316-2	2E+02	116-B-13	4E+00	100-H-24	3E+00	100-B-8:1	2E+00
116-F-14	1E+02	116-N-3	4E+00	JA JONES	3E+00	118-B-5	2E+00
100-F-35	3E+01	116-F-3	4E+00	116-F-7	3E+00	100-F-23	2E+00
316-1	3E+01	100-K-55:1	4E+00	628-1	3E+00	116-B-4	2E+00
118-B-3	2E+01	116-F-2	4E+00	600-235	3E+00	628-4	2E+00
116-B-11	2E+01	100-D-52	4E+00	600-233	3E+00	100-D-21	2E+00
118-F-8:1	2E+01	116-F-4	4E+00	600-232	3E+00	116-D-2	2E+00
100-D-48:2	1E+01	1607-D2:1	4E+00	600-204	3E+00	100-D-49:2	2E+00
116-B-1	1E+01	116-B-7	4E+00	600-190	3E+00	100-H-5	2E+00
116-DR-1&2	1E+01	1607-B8	4E+00	600-181	3E+00	116-B-6B	2E+00
100-B-14:6	1E+01	118-B-4	4E+00	600-132	3E+00	116-B-3	2E+00
118-B-10	1E+01	118-B-9	3E+00	600-131	3E+00	100-F-26:7	2E+00
116-B-14	1E+01	UPR-100-F-2	3E+00	600-128	3E+00	600-107	2E+00
116-F-6	1E+01	116-B-2	3E+00	128-C-1	3E+00	1607-D2:3	2E+00
116-C-2A	1E+01	100-B-14:7	3E+00	100-K-33	3E+00	100-F-19:1	2E+00
116-C-5	9E+00	116-DR-6	3E+00	100-K-32	3E+00	122-DR-1:2	2E+00
116-C-6	9E+00	116-B-15	3E+00	100-K-31	3E+00	1607-H2	2E+00
116-DR-9	9E+00	1607-B10	3E+00	100-K-30	3E+00	116-B-12	2E+00
100-K-56:1	9E+00	100-B-8:2	3E+00	100-K-29	3E+00	1607-D2:4	2E+00
116-D-7	9E+00	618-4	3E+00	100-F-37	3E+00	116-B-9	2E+00
116-DR-7	8E+00	100-D-48:3	3E+00	100-B-16	3E+00	600-259	2E+00
116-K-1	8E+00	600-47	3E+00	100-F-4	3E+00	600-23	2E+00
1607-H4	7E+00	100-D-4	3E+00	1607-F6	3E+00	300-10	2E+00
116-C-1	7E+00	100-H-17	3E+00	1607-B7	3E+00	128-K-1	2E+00
116-H-1	7E+00	618-5	3E+00	1607-B11	3E+00	128-F-1	2E+00
118-DR-2:2	7E+00	300-8	3E+00	100-D-22	3E+00	300 ASH PITS	2E+00
100-D-49:4	6E+00	300-18	3E+00	128-B-2	3E+00	100-F-26:1	2E+00
300-50	6E+00	116-F-9	3E+00	116-F-1	3E+00	1607-D4	2E+00
618-12	6E+00	116-H-7	3E+00	100-F-24	3E+00	100-F-38	2E+00
116-D-1A	6E+00	100-D-48:4	3E+00	116-B-10	3E+00	100-B-11	2E+00
116-KW-3	6E+00	100-C-3	3E+00	100-H-21	3E+00	100-F-12	2E+00
1607-F2	6E+00	100-B-14:3	3E+00	116-D-9	3E+00	118-C-4	2E+00
116-D-4	5E+00	100-D-48:1	3E+00	118-C-2	3E+00	100-F-7	1E+00
100-F-2	5E+00	100-C-9:3	3E+00	1607-B9	2E+00	300-45	1E+00
116-B-6A	5E+00	100-F-16	3E+00	300-49	2E+00	100-F-9	1E+00
100-D-20	5E+00	100-D-12	3E+00	100-F-19:2	2E+00	100-F-26:2	1E+00
100-F-25	5E+00	120-N-1	3E+00	100-F-26:5	2E+00	100-F-18	1E+00
116-K-2	5E+00	100-F-11	3E+00	116-DR-4	2E+00	300 VTS	1E+00
116-F-10	4E+00	116-KW-4	3E+00	100-B-14:5	2E+00	100-F-14	1E+00
116-F-11	4E+00	116-KE-5	3E+00	116-F-5	2E+00		

Table 5-27b. Rural Residential CTE Total Radiation Dose Results.

Waste Site ID	CTE Dose (mrem/yr)	Waste Site ID	CTE Dose (mrem/yr)	Waste Site ID	CTE Dose (mrem/yr)	Waste Site ID	CTE Dose (mrem/yr)
316-5	3E+01	116-F-3	2E+00	116-F-1	2E+00	1607-D2:1	1E+00
316-2	2E+01	300-18	2E+00	116-DR-6	2E+00	116-D-4	1E+00
116-F-14	9E+00	UPR-100-F-2	2E+00	118-C-2	2E+00	116-D-9	1E+00
100-F-35	5E+00	118-B-10	2E+00	100-B-5	2E+00	100-D-49:2	1E+00
100-D-49:4	4E+00	100-D-20	2E+00	116-F-4	2E+00	116-D-2	1E+00
116-C-5	4E+00	116-C-2A	2E+00	1607-F2	1E+00	116-B-10	1E+00
116-B-14	4E+00	100-F-16	2E+00	100-C-3	1E+00	100-F-19:1	1E+00
116-B-11	4E+00	100-D-12	2E+00	1607-B9	1E+00	600-259	1E+00
116-F-11	3E+00	120-N-1	2E+00	1607-B11	1E+00	1607-H2	1E+00
116-C-6	3E+00	100-F-11	2E+00	100-B-14:7	1E+00	116-B-3	1E+00
116-KW-3	3E+00	116-KW-4	2E+00	100-D-48:4	1E+00	116-B-4	1E+00
100-K-56:1	3E+00	116-KE-5	2E+00	100-D-48:3	1E+00	100-H-5	1E+00
116-DR-1&2	3E+00	100-C-9:3	2E+00	100-F-26:7	1E+00	118-B-5	1E+00
316-1	3E+00	100-H-24	2E+00	116-B-6A	1E+00	1607-D2:4	1E+00
116-K-2	2E+00	JA JONES	2E+00	1607-B8	1E+00	122-DR-1:2	1E+00
116-DR-9	2E+00	100-B-14:3	2E+00	100-D-48:1	1E+00	116-B-9	1E+00
116-H-1	2E+00	100-F-4	2E+00	1607-B7	1E+00	600-23	1E+00
618-12	2E+00	100-F-15	2E+00	116-F-9	1E+00	116-B-12	1E+00
118-F-8:1	2E+00	116-F-7	2E+00	118-B-9	1E+00	100-F-26:1	1E+00
116-N-3	2E+00	628-1	2E+00	100-H-17	1E+00	100-F-12	1E+00
100-D-48:2	2E+00	600-235	2E+00	100-H-21	1E+00	300 ASH PITS	1E+00
116-KE-4	2E+00	600-233	2E+00	100-B-8:1	1E+00	100-D-21	1E+00
100-K-55:1	2E+00	600-232	2E+00	1607-F6	1E+00	128-K-1	1E+00
116-B-1	2E+00	600-204	2E+00	116-H-7	1E+00	100-F-38	9E-01
300-50	2E+00	600-190	2E+00	116-DR-7	1E+00	100-B-14:6	9E-01
118-DR-2:2	2E+00	600-181	2E+00	116-B-15	1E+00	100-B-14:5	9E-01
116-F-10	2E+00	600-132	2E+00	100-F-19:2	1E+00	100-B-11	9E-01
116-F-2	2E+00	600-131	2E+00	1607-H4	1E+00	300-10	9E-01
100-B-8:2	2E+00	600-128	2E+00	300-49	1E+00	118-C-4	8E-01
118-B-3	2E+00	128-C-1	2E+00	100-F-23	1E+00	128-F-1	8E-01
116-F-6	2E+00	100-K-33	2E+00	1607-B10	1E+00	100-F-9	8E-01
116-C-1	2E+00	100-K-32	2E+00	100-D-52	1E+00	100-F-7	7E-01
618-4	2E+00	100-K-31	2E+00	628-4	1E+00	100-F-18	7E-01
300-8	2E+00	100-K-30	2E+00	100-D-4	1E+00	600-107	7E-01
116-B-7	2E+00	100-K-29	2E+00	100-D-22	1E+00	1607-D4	7E-01
600-47	2E+00	100-F-37	2E+00	116-B-6B	1E+00	100-F-26:2	7E-01
116-K-1	2E+00	100-B-16	2E+00	100-F-25	1E+00	300-45	7E-01
618-5	2E+00	116-B-2	2E+00	116-DR-4	1E+00	300 VTS	6E-01
118-B-4	2E+00	128-B-2	2E+00	116-B-13	1E+00	116-F-5	5E-01
116-D-1A	2E+00	116-D-7	2E+00	100-F-24	1E+00	100-F-14	4E-01
100-F-2	2E+00	100-F-26:5	2E+00	1607-D2:3	1E+00		

Table 5-28a. Rural Residential RME Incremental Radiation Dose Results.

Waste Site ID	RME Dose (mrem/yr)	Waste Site ID	RME Dose (mrem/yr)	Waste Site ID	RME Dose (mrem/yr)	Waste Site ID	RME Dose (mrem/yr)
316-5	4.E+02	116-KE-4	2.E+00	100-F-15	9.E-01	100-B-5	6.E-01
316-2	2.E+02	116-B-13	2.E+00	100-H-24	9.E-01	100-B-8:1	6.E-01
116-F-14	1.E+02	116-N-3	2.E+00	JA JONES	9.E-01	118-B-5	5.E-01
100-F-35	3.E+01	116-F-3	2.E+00	116-F-7	9.E-01	100-F-23	5.E-01
316-1	3.E+01	100-K-55:1	2.E+00	600-132	9.E-01	116-B-4	5.E-01
118-B-3	2.E+01	116-F-2	2.E+00	600-204	9.E-01	628-4	5.E-01
116-B-11	2.E+01	100-D-52	2.E+00	600-181	9.E-01	100-D-21	5.E-01
118-F-8:1	2.E+01	116-F-4	2.E+00	600-232	9.E-01	116-D-2	5.E-01
100-D-48:2	1.E+01	1607-D2:1	2.E+00	600-235	9.E-01	100-D-49:2	5.E-01
116-B-1	1.E+01	116-B-7	2.E+00	600-190	9.E-01	100-H-5	5.E-01
116-DR-1&2	1.E+01	1607-B8	2.E+00	600-233	9.E-01	116-B-6B	5.E-01
100-B-14:6	1.E+01	118-B-4	2.E+00	100-B-16	9.E-01	116-B-3	5.E-01
118-B-10	1.E+01	118-B-9	2.E+00	628-1	9.E-01	100-F-26:7	4.E-01
116-B-14	1.E+01	UPR-100-F-2	2.E+00	100-K-29	9.E-01	600-107	4.E-01
116-F-6	9.E+00	116-B-2	2.E+00	100-K-30	9.E-01	1607-D2:3	4.E-01
116-C-2A	9.E+00	100-B-14:7	1.E+00	100-K-32	9.E-01	100-F-19:1	4.E-01
116-C-5	7.E+00	116-DR-6	1.E+00	100-F-37	9.E-01	122-DR-1:2	3.E-01
116-C-6	7.E+00	116-B-15	1.E+00	100-K-31	9.E-01	1607-H2	3.E-01
116-DR-9	7.E+00	1607-B10	1.E+00	100-K-33	9.E-01	116-B-12	3.E-01
100-K-56:1	7.E+00	100-B-8:2	1.E+00	128-C-1	9.E-01	1607-D2:4	2.E-01
116-D-7	7.E+00	618-4	1.E+00	600-128	9.E-01	116-B-9	2.E-01
116-DR-7	6.E+00	100-D-48:3	1.E+00	600-131	9.E-01	600-259	2.E-01
116-K-1	6.E+00	600-47	1.E+00	100-F-4	9.E-01	600-23	2.E-01
1607-H4	5.E+00	100-D-4	1.E+00	1607-F6	9.E-01	300-10	2.E-01
116-C-1	5.E+00	100-H-17	1.E+00	1607-B7	8.E-01	128-K-1	1.E-01
116-H-1	5.E+00	618-5	1.E+00	1607-B11	8.E-01	128-F-1	1.E-01
118-DR-2:2	5.E+00	300-8	1.E+00	100-D-22	8.E-01	300 ASH PITS	1.E-01
100-D-49:4	4.E+00	300-18	1.E+00	128-B-2	8.E-01	100-F-26:1	8.E-02
300-50	4.E+00	116-F-9	1.E+00	116-F-1	8.E-01	1607-D4	7.E-02
618-12	4.E+00	116-H-7	1.E+00	100-F-24	8.E-01	100-F-38	2.E-02
116-D-1A	4.E+00	100-D-48:4	1.E+00	116-B-10	8.E-01	100-B-11	0
116-KW-3	4.E+00	100-C-3	1.E+00	100-H-21	8.E-01	100-F-12	0
1607-F2	4.E+00	100-B-14:3	1.E+00	116-D-9	7.E-01	118-C-4	0
116-D-4	3.E+00	100-D-48:1	9.E-01	118-C-2	7.E-01	100-F-7	0
100-F-2	3.E+00	100-C-9:3	9.E-01	1607-B9	7.E-01	300-45	0
116-B-6A	3.E+00	100-F-16	9.E-01	300-49	7.E-01	100-F-9	0
100-D-20	3.E+00	100-D-12	9.E-01	100-F-19:2	7.E-01	100-F-26:2	0
100-F-25	3.E+00	120-N-1	9.E-01	100-F-26:5	7.E-01	100-F-18	0
116-K-2	3.E+00	100-F-11	9.E-01	116-DR-4	7.E-01	300 VTS	0
116-F-10	3.E+00	116-KE-5	9.E-01	100-B-14:5	6.E-01	100-F-14	0
116-F-11	3.E+00	116-KW-4	9.E-01	116-F-5	6.E-01		

Table 5-28b. Rural Residential CTE Incremental Radiation Dose Results.

Waste Site ID	CTE Dose (mrem/yr)	Waste Site ID	CTE Dose (mrem/yr)	Waste Site ID	CTE Dose (mrem/yr)	Waste Site ID	CTE Dose (mrem/yr)
316-5	2.E+01	116-F-3	4.E-01	116-F-1	3.E-01	1607-D2:1	0
316-2	2.E+01	300-18	4.E-01	116-DR-6	3.E-01	116-D-4	0
116-F-14	8.E+00	UPR-100-F-2	4.E-01	118-C-2	2.E-01	116-D-9	0
100-F-35	4.E+00	118-B-10	4.E-01	100-B-5	2.E-01	100-D-49:2	0
100-D-49:4	3.E+00	100-D-20	4.E-01	116-F-4	2.E-01	116-D-2	0
116-C-5	3.E+00	116-C-2A	4.E-01	1607-F2	2.E-01	116-B-10	0
116-B-14	3.E+00	100-F-16	4.E-01	100-C-3	2.E-01	100-F-19:1	0
116-B-11	3.E+00	100-D-12	4.E-01	1607-B9	2.E-01	600-259	0
116-F-11	2.E+00	120-N-1	4.E-01	1607-B11	2.E-01	1607-H2	0
116-C-6	2.E+00	100-F-11	4.E-01	100-B-14:7	2.E-01	116-B-3	0
116-KW-3	2.E+00	116-KE-5	4.E-01	100-D-48:4	2.E-01	116-B-4	0
100-K-56:1	2.E+00	116-KW-4	4.E-01	100-D-48:3	2.E-01	100-H-5	0
116-DR-1&2	1.E+00	100-C-9:3	3.E-01	100-F-26:7	2.E-01	118-B-5	0
316-1	1.E+00	100-H-24	3.E-01	116-B-6A	2.E-01	1607-D2:4	0
116-K-2	1.E+00	JA JONES	3.E-01	1607-B8	2.E-01	122-DR-1:2	0
116-DR-9	1.E+00	100-B-14:3	3.E-01	100-D-48:1	2.E-01	116-B-9	0
116-H-1	9.E-01	100-F-4	3.E-01	1607-B7	1.E-01	600-23	0
618-12	8.E-01	100-F-15	3.E-01	116-F-9	1.E-01	116-B-12	0
118-F-8:1	8.E-01	116-F-7	3.E-01	118-B-9	1.E-01	100-F-26:1	0
116-N-3	7.E-01	600-132	3.E-01	100-H-17	1.E-01	100-F-12	0
100-D-48:2	7.E-01	100-K-29	3.E-01	100-H-21	1.E-01	300 ASH PITS	0
116-KE-4	7.E-01	600-181	3.E-01	100-B-8:1	8.E-02	100-D-21	0
100-K-55:1	7.E-01	100-K-30	3.E-01	1607-F6	7.E-02	128-K-1	0
116-B-1	6.E-01	600-190	3.E-01	116-H-7	7.E-02	100-F-38	0
300-50	6.E-01	100-K-31	3.E-01	116-DR-7	7.E-02	100-B-14:6	0
118-DR-2:2	6.E-01	600-204	3.E-01	116-B-15	6.E-02	100-B-14:5	0
116-F-10	5.E-01	100-K-32	3.E-01	100-F-19:2	6.E-02	100-B-11	0
116-F-2	5.E-01	100-F-37	3.E-01	1607-H4	4.E-02	300-10	0
100-B-8:2	5.E-01	100-K-33	3.E-01	300-49	4.E-02	118-C-4	0
118-B-3	5.E-01	100-B-16	3.E-01	100-F-23	4.E-02	128-F-1	0
116-F-6	5.E-01	600-232	3.E-01	1607-B10	4.E-02	100-F-9	0
116-C-1	5.E-01	600-233	3.E-01	100-D-52	4.E-02	100-F-7	0
618-4	5.E-01	128-C-1	3.E-01	628-4	2.E-02	100-F-18	0
300-8	5.E-01	600-235	3.E-01	100-D-4	2.E-02	600-107	0
116-B-7	5.E-01	628-1	3.E-01	100-D-22	1.E-02	1607-D4	0
600-47	5.E-01	600-128	3.E-01	116-B-6B	0	100-F-26:2	0
116-K-1	4.E-01	600-131	3.E-01	100-F-25	0	300-45	0
618-5	4.E-01	116-B-2	3.E-01	116-DR-4	0	300 VTS	0
118-B-4	4.E-01	128-B-2	3.E-01	116-B-13	0	116-F-5	0
116-D-1A	4.E-01	116-D-7	3.E-01	100-F-24	0	100-F-14	0
100-F-2	4.E-01	100-F-26:5	3.E-01	1607-D2:3	0		

Table 5-29a. Rural Residential RME Total Child Hazard Index Results.

Waste Site ID	RME HI	Waste Site ID	RME HI	Waste Site ID	RME HI	Waste Site ID	RME HI
100-K-33	2E+02	100-F-38	7E+00	116-C-1	7E+00	116-F-14	7E+00
100-K-30	4E+01	116-F-1	7E+00	116-D-2	7E+00	122-DR-1:2	7E+00
128-C-1	4E+01	1607-B9	7E+00	116-DR-6	7E+00	600-233	7E+00
100-K-32	3E+01	100-F-23	7E+00	116-DR-4	7E+00	1607-D4	7E+00
300-10	2E+01	118-C-2	7E+00	116-D-9	7E+00	116-KW-4	7E+00
100-K-31	1E+01	118-B-3	7E+00	116-B-14	7E+00	100-F-35	7E+00
618-4	1E+01	118-B-10	7E+00	100-D-49:2	7E+00	600-47	7E+00
600-23	1E+01	116-B-7	7E+00	100-D-48:2	7E+00	300-49	7E+00
316-1	1E+01	JA JONES	7E+00	116-KW-3	7E+00	600-128	7E+00
316-2	1E+01	100-F-16	7E+00	116-K-2	7E+00	118-B-5	7E+00
1607-B8	1E+01	100-D-49:4	7E+00	100-K-56:1	7E+00	600-131	7E+00
300 ASH PITS	1E+01	100-F-25	7E+00	100-K-55:1	7E+00	300-8	7E+00
118-B-9	1E+01	118-DR-2:2	7E+00	100-D-48:1	7E+00	300 VTS	7E+00
1607-H2	1E+01	116-D-4	7E+00	116-F-2	7E+00	100-F-26:5	7E+00
100-F-37	1E+01	100-H-24	7E+00	116-K-1	7E+00	100-B-14:3	7E+00
600-181	1E+01	116-DR-9	7E+00	116-DR-1&2	7E+00	100-C-9:3	7E+00
118-C-4	9E+00	118-B-4	7E+00	116-F-11	7E+00	600-107	7E+00
120-N-1	9E+00	100-F-24	7E+00	116-F-6	7E+00	600-235	7E+00
100-B-14:6	9E+00	1607-B7	7E+00	100-F-11	7E+00	100-B-11	7E+00
600-204	9E+00	UPR-100-F-2	7E+00	100-F-19:1	7E+00	100-F-9	7E+00
100-H-21	8E+00	116-C-2A	7E+00	100-F-15	7E+00	128-K-1	7E+00
600-190	8E+00	1607-D2:4	7E+00	100-F-4	7E+00	100-F-26:1	7E+00
1607-H4	8E+00	116-B-11	7E+00	116-F-7	7E+00	100-B-16	7E+00
116-B-10	8E+00	100-D-21	7E+00	1607-F2	7E+00	100-K-29	7E+00
628-4	8E+00	116-C-6	7E+00	116-F-9	7E+00	628-1	7E+00
116-H-7	8E+00	618-12	7E+00	600-259	7E+00	300-18	7E+00
100-D-22	8E+00	116-B-13	7E+00	116-B-1	7E+00	100-B-14:5	7E+00
100-B-14:7	8E+00	116-KE-4	7E+00	1607-D2:3	7E+00	100-F-26:7	7E+00
116-H-1	8E+00	116-B-6A	7E+00	100-B-5	7E+00	600-132	6E+00
1607-F6	8E+00	100-D-12	7E+00	100-B-8:2	7E+00	100-F-12	6E+00
118-F-8:1	8E+00	116-F-10	7E+00	100-F-19:2	7E+00	100-F-7	6E+00
1607-B10	8E+00	100-B-8:1	7E+00	116-B-4	7E+00	600-232	6E+00
116-B-3	8E+00	100-D-20	7E+00	116-B-12	7E+00	128-F-1	6E+00
1607-B11	8E+00	116-C-5	7E+00	116-D-7	7E+00	100-F-14	6E+00
100-D-4	8E+00	100-H-17	7E+00	116-B-2	7E+00	116-F-4	6E+00
116-B-9	7E+00	100-D-48:4	7E+00	100-D-52	7E+00	116-F-5	6E+00
300-50	7E+00	100-D-48:3	7E+00	618-5	7E+00	100-F-26:2	6E+00
116-B-15	7E+00	116-D-1A	7E+00	128-B-2	7E+00	100-F-18	6E+00
100-H-5	7E+00	100-C-3	7E+00	1607-D2:1	7E+00	316-5	5E+00
116-B-6B	7E+00	116-F-3	7E+00	100-F-2	7E+00	300-45	5E+00
116-KE-5	7E+00	116-DR-7	7E+00	116-N-3	7E+00		

Table 5-29b. Rural Residential CTE Total Child Hazard Index Results.

Waste Site ID	CTE HI	Waste Site ID	CTE HI	Waste Site ID	CTE HI	Waste Site ID	CTE HI
100-K-30	8E+00	1607-D2:4	2E+00	116-DR-1&2	2E+00	600-131	2E+00
128-C-1	6E+00	100-F-23	2E+00	116-F-11	2E+00	100-C-9:3	2E+00
100-K-31	5E+00	118-C-2	2E+00	116-B-14	2E+00	100-B-14:3	2E+00
100-K-32	5E+00	100-F-16	2E+00	116-F-2	2E+00	600-107	2E+00
100-F-37	4E+00	100-D-21	2E+00	116-F-6	2E+00	122-DR-1:2	2E+00
600-181	4E+00	116-B-6B	2E+00	100-F-11	2E+00	1607-D2:1	2E+00
316-2	4E+00	JA JONES	2E+00	116-B-3	2E+00	116-KW-4	2E+00
316-1	3E+00	100-D-20	2E+00	116-F-7	2E+00	116-F-14	2E+00
118-C-4	3E+00	100-F-25	2E+00	100-F-15	2E+00	128-K-1	2E+00
100-K-33	3E+00	UPR-100-F-2	2E+00	100-F-4	2E+00	600-47	2E+00
600-204	3E+00	116-D-4	2E+00	1607-F2	2E+00	118-B-5	2E+00
600-23	3E+00	116-B-11	2E+00	100-F-19:1	2E+00	300-49	2E+00
1607-H2	3E+00	118-B-4	2E+00	116-F-9	2E+00	600-235	2E+00
300 ASH PITS	3E+00	100-F-24	2E+00	600-259	2E+00	100-B-11	2E+00
100-H-21	3E+00	1607-B7	2E+00	116-C-5	2E+00	100-F-26:5	2E+00
618-4	3E+00	116-KE-4	2E+00	116-B-6A	2E+00	100-B-16	2E+00
116-B-15	3E+00	100-D-12	2E+00	1607-D2:3	2E+00	628-1	2E+00
600-190	3E+00	100-H-5	2E+00	116-B-1	2E+00	628-4	2E+00
100-B-14:6	3E+00	116-F-10	2E+00	116-C-1	2E+00	116-C-6	2E+00
116-H-7	3E+00	116-C-2A	2E+00	100-B-8:2	2E+00	100-F-7	2E+00
116-B-10	3E+00	100-B-8:1	2E+00	100-B-5	2E+00	600-132	2E+00
100-B-14:7	3E+00	116-B-7	2E+00	618-12	2E+00	100-F-12	2E+00
1607-H4	3E+00	116-B-13	2E+00	116-B-4	2E+00	100-B-14:5	2E+00
100-D-22	3E+00	116-D-1A	2E+00	116-B-12	2E+00	300-18	2E+00
118-F-8:1	3E+00	100-D-48:3	2E+00	116-B-2	2E+00	100-F-26:7	2E+00
116-KE-5	3E+00	100-D-48:4	2E+00	116-D-7	2E+00	100-F-26:1	2E+00
1607-B8	2E+00	116-DR-7	2E+00	100-D-52	2E+00	100-F-38	2E+00
300-10	2E+00	116-D-2	2E+00	100-F-9	2E+00	128-F-1	2E+00
1607-B10	2E+00	116-DR-6	2E+00	100-F-19:2	2E+00	600-232	2E+00
116-B-9	2E+00	116-DR-4	2E+00	618-5	2E+00	100-K-29	2E+00
1607-F6	2E+00	116-D-9	2E+00	118-B-3	2E+00	100-F-14	2E+00
118-B-9	2E+00	100-D-49:2	2E+00	100-H-17	2E+00	100-F-26:2	2E+00
116-F-1	2E+00	100-D-48:2	2E+00	100-F-2	2E+00	116-F-5	2E+00
116-H-1	2E+00	118-B-10	2E+00	118-DR-2:2	2E+00	100-F-18	2E+00
100-D-4	2E+00	116-KW-3	2E+00	116-N-3	2E+00	116-F-4	2E+00
600-128	2E+00	116-K-2	2E+00	100-C-3	2E+00	1607-D4	2E+00
1607-B11	2E+00	100-K-56:1	2E+00	300 VTS	2E+00	600-233	2E+00
100-H-24	2E+00	100-K-55:1	2E+00	100-F-35	2E+00	316-5	2E+00
116-DR-9	2E+00	116-F-3	2E+00	300-50	2E+00	120-N-1	2E+00
100-D-49:4	2E+00	100-D-48:1	2E+00	300-8	2E+00	300-45	2E+00
1607-B9	2E+00	116-K-1	2E+00	128-B-2	2E+00		

Table 5-30a. Rural Residential RME Child Hazard Index: Ratio of Background and Total HI Values.

Waste Site ID	RME HI ratio	Waste Site ID	RME HI ratio	Waste Site ID	RME HI ratio	Waste Site ID	RME HI ratio
100-K-33	9.E-02	100-F-38	1	116-C-1	1	116-F-14	1
100-K-30	5.E-01	116-F-1	1	116-D-2	1	122-DR-1:2	1
128-C-1	5.E-01	1607-B9	1	116-D-9	1	600-233	1
100-K-32	6.E-01	100-F-23	1	116-DR-4	1	1607-D4	1
300-10	8.E-01	118-C-2	1	116-DR-6	1	116-KW-4	1
100-K-31	1.E+00	118-B-3	1	116-B-14	1	100-F-35	1
618-4	1.E+00	118-B-10	1	100-D-48:2	1	600-47	1
600-23	1.E+00	116-B-7	1	100-D-49:2	1	300-49	1
316-1	1.E+00	JA JONES	1	116-KW-3	1	600-128	1
316-2	1.E+00	100-F-16	1	116-K-2	1	118-B-5	1
1607-B8	1	100-D-49:4	1	100-K-56:1	1	600-131	1
300 ASH PITS	1	100-F-25	1	100-K-55:1	1	300-8	1
118-B-9	1	118-DR-2:2	1	100-D-48:1	1	300 VTS	1
1607-H2	1	116-D-4	1	116-F-2	1	100-F-26:5	1
100-F-37	1	100-H-24	1	116-K-1	1	100-B-14:3	1
600-181	1	116-DR-9	1	116-DR-1&2	1	100-C-9:3	1
118-C-4	1	118-B-4	1	116-F-11	1	600-107	1
120-N-1	1	100-F-24	1	116-F-6	1	600-235	1
100-B-14:6	1	1607-B7	1	100-F-11	1	100-B-11	1
600-204	1	UPR-100-F-2	1	100-F-19:1	1	100-F-9	1
100-H-21	1	116-C-2A	1	100-F-15	1	128-K-1	1
600-190	1	1607-D2:4	1	100-F-4	1	100-F-26:1	1
1607-H4	1	116-B-11	1	116-F-7	1	100-B-16	1
116-B-10	1	100-D-21	1	1607-F2	1	100-K-29	1
628-4	1	116-C-6	1	116-F-9	1	628-1	1
116-H-7	1	618-12	1	600-259	1	300-18	1
100-D-22	1	116-B-13	1	116-B-1	1	100-B-14:5	1
100-B-14:7	1	116-KE-4	1	1607-D2:3	1	100-F-26:7	1
116-H-1	1	116-B-6A	1	100-B-5	1	600-132	1
1607-F6	1	100-D-12	1	100-B-8:2	1	100-F-12	1
118-F-8:1	1	116-F-10	1	100-F-19:2	1	100-F-7	1
1607-B10	1	100-B-8:1	1	116-B-4	1	600-232	1
116-B-3	1	100-D-20	1	116-B-12	1	128-F-1	1
1607-B11	1	116-C-5	1	116-D-7	1	100-F-14	1
100-D-4	1	100-H-17	1	116-B-2	1	116-F-4	1
116-B-9	1	100-D-48:4	1	100-D-52	1	116-F-5	1
300-50	1	100-D-48:3	1	618-5	1	100-F-26:2	1
116-B-15	1	116-D-1A	1	128-B-2	1	100-F-18	1
100-H-5	1	100-C-3	1	1607-D2:1	1	316-5	1
116-B-6B	1	116-F-3	1	100-F-2	1	300-45	1
116-KE-5	1	116-DR-7	1	116-N-3	1		

**Table 5-30b. Rural Residential CTE
Child Hazard Index: Ratio of Background and Total HI Values.**

Waste Site ID	CTE HI ratio	Waste Site ID	CTE HI ratio	Waste Site ID	CTE HI ratio	Waste Site ID	CTE HI ratio
100-K-30	3.E-01	1607-D2:4	8.E-01	116-DR-1&2	8.E-01	600-131	9.E-01
128-C-1	4.E-01	100-F-23	8.E-01	116-F-11	8.E-01	100-C-9:3	9.E-01
100-K-31	4.E-01	118-C-2	8.E-01	116-B-14	8.E-01	100-B-14:3	9.E-01
100-K-32	4.E-01	100-F-16	8.E-01	116-F-2	8.E-01	600-107	9.E-01
100-F-37	5.E-01	100-D-21	8.E-01	116-F-6	8.E-01	122-DR-1:2	9.E-01
600-181	6.E-01	116-B-6B	8.E-01	100-F-11	8.E-01	1607-D2:1	9.E-01
316-2	6.E-01	JA JONES	8.E-01	116-B-3	8.E-01	116-KW-4	9.E-01
316-1	6.E-01	100-D-20	8.E-01	116-F-7	8.E-01	116-F-14	9.E-01
118-C-4	6.E-01	100-F-25	8.E-01	100-F-15	8.E-01	128-K-1	9.E-01
100-K-33	6.E-01	UPR-100-F-2	8.E-01	100-F-4	8.E-01	600-47	9.E-01
600-204	7.E-01	116-D-4	8.E-01	1607-F2	8.E-01	118-B-5	9.E-01
600-23	7.E-01	116-B-11	8.E-01	100-F-19:1	8.E-01	300-49	9.E-01
1607-H2	7.E-01	118-B-4	8.E-01	116-F-9	8.E-01	600-235	9.E-01
300 ASH PITS	7.E-01	100-F-24	8.E-01	600-259	8.E-01	100-B-11	9.E-01
100-H-21	7.E-01	1607-B7	8.E-01	116-C-5	8.E-01	100-F-26:5	9.E-01
618-4	8.E-01	116-KE-4	8.E-01	116-B-6A	8.E-01	100-B-16	9.E-01
116-B-15	8.E-01	100-D-12	8.E-01	1607-D2:3	8.E-01	628-1	9.E-01
600-190	8.E-01	100-H-5	8.E-01	116-B-1	8.E-01	628-4	9.E-01
100-B-14:6	8.E-01	116-F-10	8.E-01	116-C-1	8.E-01	116-C-6	9.E-01
116-H-7	8.E-01	116-C-2A	8.E-01	100-B-8:2	8.E-01	100-F-7	9.E-01
116-B-10	8.E-01	100-B-8:1	8.E-01	100-B-5	8.E-01	600-132	9.E-01
100-B-14:7	8.E-01	116-B-7	8.E-01	618-12	8.E-01	100-F-12	9.E-01
1607-H4	8.E-01	116-B-13	8.E-01	116-B-4	8.E-01	100-B-14:5	9.E-01
100-D-22	8.E-01	116-D-1A	8.E-01	116-B-12	8.E-01	300-18	9.E-01
118-F-8:1	8.E-01	100-D-48:3	8.E-01	116-B-2	8.E-01	100-F-26:7	9.E-01
116-KE-5	8.E-01	100-D-48:4	8.E-01	116-D-7	8.E-01	100-F-26:1	9.E-01
1607-B8	8.E-01	116-DR-7	8.E-01	100-D-52	8.E-01	100-F-38	9.E-01
300-10	8.E-01	116-D-2	8.E-01	100-F-9	8.E-01	128-F-1	9.E-01
1607-B10	8.E-01	116-D-9	8.E-01	100-F-19:2	8.E-01	600-232	9.E-01
116-B-9	8.E-01	116-DR-4	8.E-01	618-5	8.E-01	100-K-29	9.E-01
1607-F6	8.E-01	116-DR-6	8.E-01	118-B-3	8.E-01	100-F-14	9.E-01
118-B-9	8.E-01	100-D-48:2	8.E-01	100-H-17	8.E-01	100-F-26:2	9.E-01
116-F-1	8.E-01	100-D-49:2	8.E-01	100-F-2	8.E-01	116-F-5	1.E+00
116-H-1	8.E-01	118-B-10	8.E-01	118-DR-2:2	8.E-01	100-F-18	1.E+00
100-D-4	8.E-01	116-KW-3	8.E-01	116-N-3	8.E-01	116-F-4	1.E+00
600-128	8.E-01	116-K-2	8.E-01	100-C-3	8.E-01	1607-D4	1.E+00
1607-B11	8.E-01	100-K-56:1	8.E-01	300 VTS	8.E-01	600-233	1.E+00
100-H-24	8.E-01	100-K-55:1	8.E-01	100-F-35	8.E-01	316-5	1.E+00
116-DR-9	8.E-01	116-F-3	8.E-01	300-50	8.E-01	120-N-1	1.E+00
100-D-49:4	8.E-01	100-D-48:1	8.E-01	300-8	8.E-01	300-45	1.E+00
1607-B9	8.E-01	116-K-1	8.E-01	128-B-2	9.E-01		

Table 5-31a. CTUIR Scenario "Local Area Only" Total Cancer Risk Results.

Waste Site ID	Cancer Risk	Waste Site ID	Cancer Risk	Waste Site ID	Cancer Risk	Waste Site ID	Cancer Risk
300-10	>1E-02	100-K-56:1	1E-02	116-F-2	1E-02	100-C-3	9E-03
100-F-37	>1E-02	100-F-19:1	1E-02	100-F-24	1E-02	600-204	9E-03
100-F-35	>1E-02	116-C-1	1E-02	100-D-12	1E-02	122-DR-1:2	9E-03
316-5	>1E-02	100-F-2	1E-02	100-D-48:1	1E-02	600-131	9E-03
316-1	>1E-02	116-D-1A	1E-02	116-DR-4	1E-02	128-B-2	9E-03
316-2	>1E-02	116-B-6A	1E-02	116-B-6B	1E-02	100-F-26:1	9E-03
116-DR-1&2	>1E-02	116-DR-7	1E-02	100-F-15	1E-02	116-KW-4	9E-03
100-H-21	>1E-02	116-KE-4	1E-02	100-F-4	1E-02	1607-D2:1	8E-03
1607-H4	>1E-02	116-K-2	1E-02	100-F-11	1E-02	100-F-38	8E-03
116-F-6	>1E-02	100-D-48:3	1E-02	116-F-7	1E-02	118-C-4	8E-03
618-12	>1E-02	116-KW-3	1E-02	116-B-10	1E-02	100-F-26:5	8E-03
116-B-15	>1E-02	116-B-13	1E-02	116-B-3	1E-02	100-B-14:5	8E-03
116-H-1	>1E-02	100-D-22	1E-02	100-B-8:1	1E-02	118-B-5	8E-03
116-F-14	>1E-02	100-D-20	1E-02	1607-D2:4	1E-02	600-47	8E-03
1607-H2	>1E-02	116-B-2	1E-02	116-B-9	1E-02	120-N-1	8E-03
116-C-6	>1E-02	116-D-4	1E-02	116-B-4	1E-02	128-K-1	8E-03
300 ASH PITS	>1E-02	1607-F2	1E-02	1607-D2:3	1E-02	100-B-16	8E-03
300-50	>1E-02	UPR-100-F-2	1E-02	100-F-19:2	1E-02	600-181	8E-03
118-B-9	1E-02	116-F-10	1E-02	100-D-49:2	1E-02	628-1	8E-03
1607-D4	1E-02	116-N-3	1E-02	100-D-21	1E-02	600-190	8E-03
116-H-7	1E-02	118-B-10	1E-02	100-B-5	1E-02	100-K-32	8E-03
1607-B11	1E-02	100-B-8:2	1E-02	116-D-2	1E-02	100-K-30	8E-03
116-B-11	1E-02	100-D-4	1E-02	116-B-12	1E-02	100-F-26:7	7E-03
116-F-1	1E-02	116-DR-6	1E-02	600-259	1E-02	100-K-31	7E-03
118-F-8:1	1E-02	300-49	1E-02	300-8	1E-02	100-F-12	7E-03
118-DR-2:2	1E-02	100-F-25	1E-02	100-C-9:3	1E-02	300-18	7E-03
118-B-3	1E-02	1607-F6	1E-02	100-B-14:3	1E-02	100-F-7	7E-03
116-C-2A	1E-02	118-B-4	1E-02	628-4	1E-02	600-132	6E-03
100-H-5	1E-02	100-F-23	1E-02	100-B-11	1E-02	100-F-9	6E-03
116-B-14	1E-02	100-K-55:1	1E-02	600-107	1E-02	100-K-29	6E-03
100-B-14:7	1E-02	600-235	1E-02	100-H-24	1E-02	116-F-4	6E-03
116-D-7	1E-02	116-F-3	1E-02	618-5	1E-02	600-128	6E-03
116-K-1	1E-02	116-F-11	1E-02	300 VTS	1E-02	600-232	6E-03
100-D-48:2	1E-02	100-D-48:4	1E-02	100-K-33	1E-02	100-F-26:2	5E-03
116-F-9	1E-02	116-D-9	1E-02	100-H-17	1E-02	128-F-1	5E-03
116-C-5	1E-02	118-C-2	1E-02	1607-B9	1E-02	100-F-14	5E-03
116-B-1	1E-02	100-D-52	1E-02	100-B-14:6	1E-02	116-F-5	5E-03
100-D-49:4	1E-02	116-B-7	1E-02	600-23	1E-02	100-F-18	4E-03
1607-B8	1E-02	100-F-16	1E-02	618-4	1E-02	600-233	2E-03
116-DR-9	1E-02	128-C-1	1E-02	116-KE-5	1E-02	300-45	1E-03
1607-B10	1E-02	JA JONES	1E-02	1607-B7	1E-02		

Table 5-31b. CTUIR Scenario "Local and Broad Areas" Total Cancer Risk Results.

Waste Site ID	Cancer Risk	Waste Site ID	Cancer Risk	Waste Site ID	Cancer Risk	Waste Site ID	Cancer Risk
316-5	>1E-02	118-B-9	>1E-02	100-F-15	>1E-02	1607-D4	>1E-02
116-F-14	>1E-02	116-F-3	>1E-02	100-F-11	>1E-02	116-B-4	>1E-02
316-2	>1E-02	116-N-3	>1E-02	100-F-4	>1E-02	116-B-3	>1E-02
300-10	>1E-02	618-4	>1E-02	116-F-7	>1E-02	1607-D2:3	>1E-02
118-B-3	>1E-02	100-K-55:1	>1E-02	100-H-24	>1E-02	116-F-9	>1E-02
116-B-11	>1E-02	118-DR-2:2	>1E-02	1607-F6	>1E-02	600-232	>1E-02
316-1	>1E-02	116-B-13	>1E-02	100-D-48:1	>1E-02	628-1	>1E-02
118-F-8:1	>1E-02	116-B-15	>1E-02	100-K-33	>1E-02	120-N-1	>1E-02
100-D-48:2	>1E-02	100-F-25	>1E-02	300-8	>1E-02	100-F-26:5	>1E-02
116-B-1	>1E-02	600-235	>1E-02	300 ASH PITS	>1E-02	100-K-30	>1E-02
100-B-14:6	>1E-02	116-F-6	>1E-02	600-181	>1E-02	600-107	>1E-02
118-B-10	>1E-02	116-F-2	>1E-02	100-D-22	>1E-02	100-F-19:1	>1E-02
1607-H4	>1E-02	100-D-52	>1E-02	628-4	>1E-02	116-B-9	>1E-02
116-B-14	>1E-02	118-B-4	>1E-02	118-C-2	>1E-02	116-B-12	>1E-02
116-C-2A	>1E-02	116-B-7	>1E-02	1607-B9	>1E-02	600-259	>1E-02
116-C-6	>1E-02	118-C-4	>1E-02	116-KE-5	>1E-02	1607-D2:4	>1E-02
100-K-56:1	>1E-02	UPR-100-F-2	>1E-02	116-F-4	>1E-02	100-K-32	>1E-02
116-C-5	>1E-02	100-B-14:7	>1E-02	100-C-9:3	>1E-02	300-18	>1E-02
116-DR-9	>1E-02	1607-B8	>1E-02	100-C-3	>1E-02	118-B-5	>1E-02
116-D-7	>1E-02	116-B-6A	>1E-02	100-B-14:3	>1E-02	122-DR-1:2	>1E-02
100-F-37	>1E-02	116-B-2	>1E-02	100-H-17	>1E-02	100-K-31	>1E-02
116-DR-7	>1E-02	600-23	>1E-02	100-F-24	>1E-02	100-B-14:5	>1E-02
116-H-1	>1E-02	116-H-7	>1E-02	1607-B7	>1E-02	600-132	>1E-02
116-K-1	>1E-02	600-190	>1E-02	116-B-10	>1E-02	600-128	>1E-02
116-C-1	>1E-02	100-D-4	>1E-02	600-47	>1E-02	100-K-29	>1E-02
100-F-35	>1E-02	1607-D2:1	>1E-02	300-49	>1E-02	100-F-26:7	>1E-02
600-233	>1E-02	116-DR-6	>1E-02	100-F-23	>1E-02	128-K-1	>1E-02
100-D-49:4	>1E-02	116-DR-1&2	>1E-02	100-B-5	>1E-02	100-B-11	>1E-02
300-50	>1E-02	100-B-8:2	>1E-02	100-F-19:2	>1E-02	100-F-26:1	>1E-02
1607-F2	>1E-02	1607-B11	>1E-02	116-DR-4	>1E-02	100-F-38	>1E-02
116-KW-3	>1E-02	1607-H2	>1E-02	600-131	>1E-02	116-F-5	>1E-02
116-D-1A	>1E-02	128-C-1	>1E-02	116-KW-4	>1E-02	300 VTS	>1E-02
618-12	>1E-02	116-F-1	>1E-02	100-B-8:1	>1E-02	100-F-12	>1E-02
116-D-4	>1E-02	100-D-48:3	>1E-02	100-D-21	>1E-02	100-F-7	>1E-02
100-H-21	>1E-02	1607-B10	>1E-02	116-D-9	>1E-02	100-F-9	>1E-02
116-F-11	>1E-02	618-5	>1E-02	128-B-2	>1E-02	128-F-1	>1E-02
116-F-10	>1E-02	100-F-16	>1E-02	100-B-16	>1E-02	100-F-26:2	>1E-02
100-F-2	>1E-02	JA JONES	>1E-02	116-B-6B	>1E-02	100-F-18	>1E-02
116-K-2	>1E-02	600-204	>1E-02	100-D-49:2	>1E-02	100-F-14	>1E-02
100-D-20	>1E-02	100-D-12	>1E-02	116-D-2	>1E-02	300-45	>1E-02
116-KE-4	>1E-02	100-D-48:4	>1E-02	100-H-5	>1E-02		

Table 5-32a. CTUIR Scenario "Local Area Only" ILCR Results.

Waste Site ID	ILCR	Waste Site ID	ILCR	Waste Site ID	ILCR	Waste Site ID	ILCR
300-10	>1E-02	100-K-56:1	4.E-03	116-F-2	3.E-03	100-C-3	2.E-03
100-F-37	>1E-02	100-F-19:1	4.E-03	100-F-24	3.E-03	600-204	2.E-03
100-F-35	>1E-02	116-C-1	4.E-03	100-D-12	3.E-03	122-DR-1:2	2.E-03
316-5	>1E-02	100-F-2	4.E-03	100-D-48:1	3.E-03	600-131	1.E-03
316-1	>1E-02	116-D-1A	4.E-03	116-DR-4	3.E-03	128-B-2	1.E-03
316-2	>1E-02	116-B-6A	4.E-03	116-B-6B	3.E-03	100-F-26:1	1.E-03
116-DR-1&2	>1E-02	116-DR-7	4.E-03	100-F-15	3.E-03	116-KW-4	1.E-03
100-H-21	1.E-02	116-KE-4	3.E-03	100-F-4	3.E-03	1607-D2:1	1.E-03
1607-H4	1.E-02	116-K-2	3.E-03	100-F-11	3.E-03	100-F-38	9.E-04
116-F-6	1.E-02	100-D-48:3	3.E-03	116-F-7	3.E-03	118-C-4	9.E-04
618-12	9.E-03	116-KW-3	3.E-03	116-B-10	3.E-03	100-F-26:5	8.E-04
116-B-15	9.E-03	116-B-13	3.E-03	116-B-3	3.E-03	100-B-14:5	8.E-04
116-H-1	9.E-03	100-D-22	3.E-03	100-B-8:1	3.E-03	118-B-5	8.E-04
116-F-14	8.E-03	100-D-20	3.E-03	1607-D2:4	3.E-03	600-47	7.E-04
1607-H2	8.E-03	116-B-2	3.E-03	116-B-9	3.E-03	120-N-1	6.E-04
116-C-6	8.E-03	116-D-4	3.E-03	116-B-4	3.E-03	128-K-1	4.E-04
300 ASH PITS	8.E-03	1607-F2	3.E-03	1607-D2:3	3.E-03	100-B-16	4.E-04
300-50	8.E-03	UPR-100-F-2	3.E-03	100-F-19:2	3.E-03	600-181	3.E-04
118-B-9	7.E-03	116-F-10	3.E-03	100-D-49:2	3.E-03	628-1	3.E-04
1607-D4	6.E-03	116-N-3	3.E-03	100-D-21	3.E-03	600-190	3.E-04
116-H-7	5.E-03	118-B-10	3.E-03	100-B-5	3.E-03	100-K-32	2.E-04
1607-B11	5.E-03	100-B-8:2	3.E-03	116-D-2	3.E-03	100-K-30	5.E-05
116-B-11	5.E-03	100-D-4	3.E-03	116-B-12	3.E-03	100-F-26:7	0
116-F-1	5.E-03	116-DR-6	3.E-03	600-259	3.E-03	100-K-31	0
118-F-8:1	5.E-03	300-49	3.E-03	300-8	3.E-03	100-F-12	0
118-DR-2:2	5.E-03	100-F-25	3.E-03	100-C-9:3	3.E-03	300-18	0
118-B-3	5.E-03	1607-F6	3.E-03	100-B-14:3	3.E-03	100-F-7	0
116-C-2A	5.E-03	118-B-4	3.E-03	628-4	3.E-03	600-132	0
100-H-5	4.E-03	100-F-23	3.E-03	100-B-11	3.E-03	100-F-9	0
116-B-14	4.E-03	100-K-55:1	3.E-03	600-107	3.E-03	100-K-29	0
100-B-14:7	4.E-03	600-235	3.E-03	100-H-24	3.E-03	116-F-4	0
116-D-7	4.E-03	116-F-3	3.E-03	618-5	3.E-03	600-128	0
116-K-1	4.E-03	116-F-11	3.E-03	300 VTS	3.E-03	600-232	0
100-D-48:2	4.E-03	100-D-48:4	3.E-03	100-K-33	3.E-03	100-F-26:2	0
116-F-9	4.E-03	116-D-9	3.E-03	100-H-17	3.E-03	128-F-1	0
116-C-5	4.E-03	118-C-2	3.E-03	1607-B9	3.E-03	100-F-14	0
116-B-1	4.E-03	100-D-52	3.E-03	100-B-14:6	3.E-03	116-F-5	0
100-D-49:4	4.E-03	116-B-7	3.E-03	600-23	3.E-03	100-F-18	0
1607-B8	4.E-03	100-F-16	3.E-03	618-4	3.E-03	600-233	0
116-DR-9	4.E-03	128-C-1	3.E-03	116-KE-5	2.E-03	300-45	0
1607-B10	4.E-03	JA JONES	3.E-03	1607-B7	2.E-03		

Table 5-32b. CTUIR Scenario "Local and Broad Areas" ILCR Results.

Waste Site ID	ILCR	Waste Site ID	ILCR	Waste Site ID	ILCR	Waste Site ID	ILCR
316-5	>1E-02	116-KE-4	>1E-02	116-F-7	>1E-02	116-B-12	>1E-02
116-F-14	>1E-02	100-H-21	>1E-02	JA JONES	>1E-02	116-B-9	>1E-02
316-2	>1E-02	116-B-13	>1E-02	100-F-16	>1E-02	1607-D4	>1E-02
300-10	>1E-02	100-F-25	>1E-02	1607-F6	>1E-02	1607-D2:4	>1E-02
118-B-3	>1E-02	116-F-6	>1E-02	1607-B11	>1E-02	300-49	>1E-02
116-B-11	>1E-02	116-F-2	>1E-02	116-F-1	>1E-02	128-B-2	>1E-02
118-F-8:1	>1E-02	118-B-9	>1E-02	100-F-24	>1E-02	116-KW-4	>1E-02
316-1	>1E-02	100-D-52	>1E-02	118-C-2	>1E-02	600-131	>1E-02
100-D-48:2	>1E-02	118-B-4	>1E-02	1607-H2	>1E-02	100-H-5	>1E-02
116-B-1	>1E-02	116-B-7	>1E-02	1607-B10	>1E-02	600-47	>1E-02
100-B-14:6	>1E-02	UPR-100-F-2	>1E-02	116-B-10	>1E-02	100-F-26:5	>1E-02
118-B-10	>1E-02	118-DR-2:2	>1E-02	128-C-1	>1E-02	100-B-16	>1E-02
1607-H4	>1E-02	116-B-15	>1E-02	100-D-21	>1E-02	300 VTS	>1E-02
116-B-14	>1E-02	100-F-2	>1E-02	100-B-5	>1E-02	118-B-5	>1E-02
116-C-2A	>1E-02	618-4	>1E-02	100-F-19:2	>1E-02	100-B-14:5	>1E-02
100-K-56:1	>1E-02	116-B-6A	>1E-02	116-DR-4	>1E-02	600-232	>1E-02
116-DR-9	>1E-02	116-B-2	>1E-02	100-B-8:1	>1E-02	628-1	>1E-02
116-C-5	>1E-02	600-235	>1E-02	116-D-9	>1E-02	100-K-30	>1E-02
116-C-6	>1E-02	100-D-4	>1E-02	100-F-23	>1E-02	120-N-1	>1E-02
116-D-7	>1E-02	116-DR-6	>1E-02	1607-D2:3	>1E-02	122-DR-1:2	>1E-02
116-DR-7	>1E-02	100-B-14:7	>1E-02	100-D-49:2	>1E-02	100-K-32	>1E-02
100-F-37	>1E-02	118-C-4	>1E-02	116-D-2	>1E-02	128-K-1	>1E-02
116-K-1	>1E-02	1607-B8	>1E-02	600-204	>1E-02	100-F-26:7	>1E-02
100-F-35	>1E-02	116-DR-1&2	>1E-02	300 ASH PITS	>1E-02	300-18	>1E-02
116-H-1	>1E-02	100-B-8:2	>1E-02	116-F-9	>1E-02	100-K-31	>1E-02
116-C-1	>1E-02	100-C-9:3	>1E-02	1607-B9	>1E-02	100-B-11	>1E-02
100-D-49:4	>1E-02	600-23	>1E-02	116-B-4	>1E-02	600-132	>1E-02
1607-F2	>1E-02	100-D-48:3	>1E-02	100-H-24	>1E-02	600-128	>1E-02
600-233	>1E-02	100-B-14:3	>1E-02	618-5	>1E-02	100-K-29	>1E-02
116-KW-3	>1E-02	116-H-7	>1E-02	100-K-33	>1E-02	100-F-26:1	>1E-02
116-D-1A	>1E-02	1607-D2:1	>1E-02	116-B-3	>1E-02	100-F-38	>1E-02
300-50	>1E-02	100-D-48:4	>1E-02	628-4	>1E-02	116-F-5	>1E-02
116-F-11	>1E-02	100-D-22	>1E-02	116-B-6B	>1E-02	100-F-12	>1E-02
116-D-4	>1E-02	100-D-48:1	>1E-02	1607-B7	>1E-02	100-F-7	>1E-02
116-F-10	>1E-02	300-8	>1E-02	116-F-4	>1E-02	100-F-9	>1E-02
116-K-2	>1E-02	600-107	>1E-02	100-C-3	>1E-02	128-F-1	>1E-02
100-D-20	>1E-02	600-190	>1E-02	100-F-19:1	>1E-02	100-F-26:2	>1E-02
116-N-3	>1E-02	100-F-15	>1E-02	100-H-17	>1E-02	100-F-18	>1E-02
618-12	>1E-02	100-F-11	>1E-02	600-259	>1E-02	100-F-14	>1E-02
116-F-3	>1E-02	100-F-4	>1E-02	116-KE-5	>1E-02	300-45	>1E-02
100-K-55:1	>1E-02	100-D-12	>1E-02	600-181	>1E-02		

Table 5-33a. CTUIR Scenario "Local Area Only" Total Radiation Dose Results.

Waste Site ID	Rad Dose (mrem/yr)	Waste Site ID	Rad Dose (mrem/yr)	Waste Site ID	Rad Dose (mrem/yr)	Waste Site ID	Rad Dose (mrem/yr)
100-F-35	6E+02	116-KE-4	1E+01	116-F-5	6E+00	100-B-14:5	5E+00
316-5	6E+02	116-KW-3	1E+01	100-D-48:1	6E+00	1607-B9	5E+00
116-DR-1&2	3E+02	116-F-4	1E+01	116-DR-4	6E+00	116-B-4	5E+00
316-2	3E+02	116-K-2	1E+01	116-H-7	6E+00	100-F-26:5	5E+00
116-F-6	2E+02	116-B-2	9E+00	300-49	6E+00	116-B-3	5E+00
116-F-14	1E+02	100-H-5	9E+00	118-C-2	5E+00	122-DR-1:2	5E+00
118-DR-2:2	7E+01	116-N-3	9E+00	100-B-14:3	5E+00	300-10	5E+00
316-1	5E+01	1607-B10	9E+00	100-F-16	5E+00	116-B-10	5E+00
116-B-11	5E+01	1607-F2	9E+00	100-C-9:3	5E+00	100-F-19:2	5E+00
118-F-8:1	4E+01	116-D-4	8E+00	100-F-11	5E+00	100-B-8:1	5E+00
116-C-2A	3E+01	116-F-10	8E+00	100-F-15	5E+00	1607-D2:3	5E+00
116-B-14	3E+01	128-F-1	8E+00	100-D-12	5E+00	118-B-5	5E+00
118-B-3	3E+01	100-B-8:2	8E+00	120-N-1	5E+00	116-B-6B	5E+00
116-D-7	3E+01	1607-D2:1	8E+00	116-KE-5	5E+00	1607-D2:4	5E+00
116-K-1	3E+01	100-B-11	8E+00	116-KW-4	5E+00	100-F-26:7	5E+00
116-H-1	3E+01	100-D-22	8E+00	100-H-24	5E+00	100-B-5	5E+00
116-F-9	2E+01	116-DR-6	7E+00	116-F-7	5E+00	100-D-49:2	5E+00
116-C-6	2E+01	116-D-9	7E+00	JA JONES	5E+00	100-D-21	5E+00
100-D-48:2	2E+01	116-F-1	7E+00	100-B-16	5E+00	600-107	5E+00
116-C-5	2E+01	116-F-3	7E+00	100-F-37	5E+00	1607-D4	5E+00
118-B-10	2E+01	100-K-55:1	7E+00	100-K-29	5E+00	300 ASH PITS	5E+00
116-B-1	2E+01	100-D-48:4	7E+00	100-K-30	5E+00	116-D-2	5E+00
100-B-14:6	2E+01	116-F-11	7E+00	100-K-31	5E+00	128-K-1	5E+00
116-DR-7	2E+01	118-B-4	7E+00	100-K-32	5E+00	600-23	5E+00
116-DR-9	2E+01	116-F-2	6E+00	100-K-33	5E+00	116-B-9	5E+00
100-D-49:4	1E+01	100-D-52	6E+00	128-C-1	5E+00	100-F-38	5E+00
116-D-1A	1E+01	100-C-3	6E+00	600-128	5E+00	1607-H2	5E+00
116-B-6A	1E+01	116-B-7	6E+00	600-131	5E+00	600-259	4E+00
100-H-17	1E+01	UPR-100-F-2	6E+00	600-132	5E+00	116-B-12	4E+00
100-F-2	1E+01	100-F-24	6E+00	600-181	5E+00	100-F-26:1	4E+00
116-C-1	1E+01	618-4	6E+00	600-190	5E+00	300-45	4E+00
1607-B8	1E+01	100-D-4	6E+00	600-204	5E+00	100-F-7	4E+00
100-F-25	1E+01	118-B-9	6E+00	600-232	5E+00	116-B-15	4E+00
100-K-56:1	1E+01	1607-B11	6E+00	600-233	5E+00	100-F-26:2	4E+00
618-12	1E+01	600-47	6E+00	600-235	5E+00	100-F-9	4E+00
1607-H4	1E+01	100-B-14:7	6E+00	628-1	5E+00	100-F-14	3E+00
100-F-19:1	1E+01	1607-F6	6E+00	100-F-4	5E+00	118-C-4	3E+00
300-50	1E+01	300-8	6E+00	128-B-2	5E+00	100-F-12	3E+00
100-D-20	1E+01	618-5	6E+00	1607-B7	5E+00	100-F-18	3E+00
100-D-48:3	1E+01	300-18	6E+00	628-4	5E+00	300 VTS	2E+00
116-B-13	1E+01	100-F-23	6E+00	100-H-21	5E+00		

Table 5-33b. CTUIR Scenario "Local and Broad Areas" Total Radiation Dose Results.

Waste Site ID	Rad Dose (mrem/yr)	Waste Site ID	Rad Dose (mrem/yr)	Waste Site ID	Rad Dose (mrem/yr)	Waste Site ID	Rad Dose (mrem/yr)
316-5	4E+02	116-B-13	4E+01	100-H-24	4E+01	116-B-4	4E+01
316-2	2E+02	116-N-3	4E+01	JA JONES	4E+01	118-B-5	4E+01
116-F-14	1E+02	100-K-55:1	4E+01	116-F-7	4E+01	100-F-23	4E+01
118-B-3	6E+01	116-F-2	4E+01	100-B-16	4E+01	128-F-1	4E+01
316-1	6E+01	116-B-6A	4E+01	100-F-37	4E+01	100-B-8:1	4E+01
116-B-11	6E+01	1607-D2:1	4E+01	100-K-29	4E+01	100-D-21	4E+01
118-F-8:1	6E+01	116-F-6	4E+01	100-K-30	4E+01	116-D-2	4E+01
100-D-48:2	5E+01	100-D-52	4E+01	100-K-31	4E+01	628-4	4E+01
116-B-1	5E+01	118-B-4	4E+01	100-K-32	4E+01	100-D-49:2	4E+01
100-B-14:6	5E+01	116-B-7	4E+01	100-K-33	4E+01	116-B-6B	4E+01
118-B-10	5E+01	1607-B10	4E+01	128-C-1	4E+01	100-F-26:7	4E+01
116-B-14	5E+01	UPR-100-F-2	4E+01	600-128	4E+01	116-B-3	4E+01
116-C-2A	5E+01	116-F-4	4E+01	600-131	4E+01	600-107	4E+01
116-C-6	5E+01	118-B-9	4E+01	600-132	4E+01	1607-D2:3	4E+01
116-C-5	5E+01	116-B-2	4E+01	600-181	4E+01	116-F-9	4E+01
116-DR-9	5E+01	100-B-14:7	4E+01	600-190	4E+01	100-H-5	4E+01
100-K-56:1	5E+01	116-DR-6	4E+01	600-204	4E+01	116-B-12	4E+01
116-DR-7	5E+01	116-B-15	4E+01	600-232	4E+01	1607-H2	4E+01
116-D-7	5E+01	100-D-4	4E+01	600-233	4E+01	122-DR-1:2	4E+01
100-F-35	5E+01	100-B-8:2	4E+01	600-235	4E+01	100-F-19:1	4E+01
116-K-1	5E+01	116-DR-1&2	4E+01	628-1	4E+01	600-259	4E+01
1607-H4	5E+01	618-4	4E+01	100-F-4	4E+01	1607-D2:4	4E+01
116-C-1	5E+01	600-47	4E+01	100-D-48:1	4E+01	116-B-9	4E+01
100-D-49:4	5E+01	618-5	4E+01	100-F-24	4E+01	600-23	4E+01
116-H-1	5E+01	300-8	4E+01	100-H-17	4E+01	128-K-1	4E+01
116-D-1A	5E+01	300-18	4E+01	1607-B7	4E+01	100-F-26:1	4E+01
1607-F2	5E+01	100-D-48:3	4E+01	128-B-2	4E+01	1607-D4	4E+01
116-KW-3	5E+01	116-H-7	4E+01	116-F-1	4E+01	300 ASH PITS	4E+01
300-50	5E+01	100-C-3	4E+01	100-H-21	4E+01	100-F-38	4E+01
100-F-25	5E+01	100-B-14:3	4E+01	100-D-22	4E+01	300-10	4E+01
116-D-4	4E+01	1607-B11	4E+01	1607-B9	4E+01	100-F-12	4E+01
100-D-20	4E+01	100-C-9:3	4E+01	116-B-10	4E+01	100-B-11	4E+01
100-F-2	4E+01	1607-F6	4E+01	118-C-2	4E+01	118-C-4	4E+01
1607-B8	4E+01	100-F-16	4E+01	100-F-26:5	4E+01	100-F-7	4E+01
116-F-11	4E+01	100-F-11	4E+01	100-B-14:5	4E+01	100-F-9	4E+01
116-F-10	4E+01	100-D-12	4E+01	100-B-5	4E+01	100-F-26:2	4E+01
618-12	4E+01	100-F-15	4E+01	100-F-19:2	4E+01	100-F-18	4E+01
116-K-2	4E+01	100-D-48:4	4E+01	116-DR-4	4E+01	300 VTS	4E+01
118-DR-2:2	4E+01	120-N-1	4E+01	300-49	4E+01	300-45	4E+01
116-KE-4	4E+01	116-KE-5	4E+01	116-D-9	4E+01	100-F-14	4E+01
116-F-3	4E+01	116-KW-4	4E+01	116-F-5	4E+01		

Table 5-34a. CTUIR Scenario "Local Area Only" Incremental Radiation Dose Results.

Waste Site ID	Rad Dose (mrem/yr)	Waste Site ID	Rad Dose (mrem/yr)	Waste Site ID	Rad Dose (mrem/yr)	Waste Site ID	Rad Dose (mrem/yr)
100-F-35	6.E+02	116-KE-4	6.E+00	116-F-5	8.E-01	100-B-14:5	4.E-01
316-5	6.E+02	116-KW-3	5.E+00	100-D-48:1	8.E-01	1607-B9	4.E-01
116-DR-1&2	3.E+02	116-F-4	5.E+00	116-DR-4	7.E-01	116-B-4	4.E-01
316-2	3.E+02	116-K-2	5.E+00	116-H-7	7.E-01	100-F-26:5	4.E-01
116-F-6	2.E+02	116-B-2	4.E+00	300-49	7.E-01	116-B-3	3.E-01
116-F-14	1.E+02	100-H-5	4.E+00	118-C-2	7.E-01	122-DR-1:2	3.E-01
118-DR-2:2	7.E+01	116-N-3	4.E+00	100-B-14:3	7.E-01	300-10	2.E-01
316-1	5.E+01	1607-B10	4.E+00	100-F-16	7.E-01	116-B-10	2.E-01
116-B-11	4.E+01	1607-F2	4.E+00	100-C-9:3	6.E-01	100-F-19:2	1.E-01
118-F-8:1	4.E+01	116-D-4	4.E+00	100-F-11	6.E-01	100-B-8:1	1.E-01
116-C-2A	3.E+01	116-F-10	3.E+00	100-F-15	6.E-01	1607-D2:3	9.E-02
116-B-14	3.E+01	128-F-1	3.E+00	100-D-12	6.E-01	118-B-5	4.E-02
118-B-3	2.E+01	100-B-8:2	3.E+00	120-N-1	6.E-01	116-B-6B	0
116-D-7	2.E+01	1607-D2:1	3.E+00	116-KE-5	6.E-01	1607-D2:4	0
116-K-1	2.E+01	100-B-11	3.E+00	116-KW-4	6.E-01	100-F-26:7	0
116-H-1	2.E+01	100-D-22	3.E+00	100-H-24	6.E-01	100-B-5	0
116-F-9	2.E+01	116-DR-6	3.E+00	116-F-7	6.E-01	100-D-49:2	0
116-C-6	2.E+01	116-D-9	2.E+00	JA JONES	6.E-01	100-D-21	0
100-D-48:2	2.E+01	116-F-1	2.E+00	600-132	6.E-01	600-107	0
116-C-5	2.E+01	116-F-3	2.E+00	600-204	6.E-01	1607-D4	0
118-B-10	1.E+01	100-K-55:1	2.E+00	600-181	6.E-01	300 ASH PITS	0
116-B-1	1.E+01	100-D-48:4	2.E+00	600-232	6.E-01	116-D-2	0
100-B-14:6	1.E+01	116-F-11	2.E+00	600-235	6.E-01	128-K-1	0
116-DR-7	1.E+01	118-B-4	2.E+00	600-190	6.E-01	600-23	0
116-DR-9	1.E+01	116-F-2	2.E+00	600-233	6.E-01	116-B-9	0
100-D-49:4	1.E+01	100-D-52	2.E+00	100-B-16	6.E-01	100-F-38	0
116-D-1A	9.E+00	100-C-3	2.E+00	628-1	6.E-01	1607-H2	0
116-B-6A	9.E+00	116-B-7	2.E+00	100-K-29	6.E-01	600-259	0
100-H-17	8.E+00	UPR-100-F-2	1.E+00	100-K-30	6.E-01	116-B-12	0
100-F-2	8.E+00	100-F-24	1.E+00	100-K-32	6.E-01	100-F-26:1	0
116-C-1	8.E+00	618-4	1.E+00	100-F-37	6.E-01	300-45	0
1607-B8	8.E+00	100-D-4	1.E+00	100-K-31	6.E-01	100-F-7	0
100-F-25	8.E+00	118-B-9	1.E+00	100-K-33	6.E-01	116-B-15	0
100-K-56:1	8.E+00	1607-B11	1.E+00	128-C-1	6.E-01	100-F-26:2	0
618-12	8.E+00	600-47	1.E+00	600-128	6.E-01	100-F-9	0
1607-H4	7.E+00	100-B-14:7	1.E+00	600-131	6.E-01	100-F-14	0
100-F-19:1	6.E+00	1607-F6	1.E+00	100-F-4	6.E-01	118-C-4	0
300-50	6.E+00	300-8	1.E+00	128-B-2	6.E-01	100-F-12	0
100-D-20	6.E+00	618-5	1.E+00	1607-B7	5.E-01	100-F-18	0
100-D-48:3	6.E+00	300-18	1.E+00	628-4	5.E-01	300 VTS	0
116-B-13	6.E+00	100-F-23	1.E+00	100-H-21	5.E-01		

Table 5-34b. CTUIR Scenario
"Local and Broad Areas" Incremental Radiation Dose Results.

Waste Site ID	Rad Dose (mrem/yr)	Waste Site ID	Rad Dose (mrem/yr)	Waste Site ID	Rad Dose (mrem/yr)	Waste Site ID	Rad Dose (mrem/yr)
316-5	2.E+02	116-B-13	0	100-H-24	0	116-B-4	0
316-2	0	116-N-3	0	JA JONES	0	118-B-5	0
116-F-14	0	100-K-55:1	0	116-F-7	0	100-F-23	0
118-B-3	0	116-F-2	0	600-132	0	128-F-1	0
316-1	0	116-B-6A	0	600-204	0	100-B-8:1	0
116-B-11	0	1607-D2:1	0	600-181	0	100-D-21	0
118-F-8:1	0	116-F-6	0	600-232	0	116-D-2	0
100-D-48:2	0	100-D-52	0	600-235	0	628-4	0
116-B-1	0	118-B-4	0	600-190	0	100-D-49:2	0
100-B-14:6	0	116-B-7	0	600-233	0	116-B-6B	0
118-B-10	0	1607-B10	0	100-B-16	0	100-F-26:7	0
116-B-14	0	UPR-100-F-2	0	628-1	0	116-B-3	0
116-C-2A	0	116-F-4	0	100-K-29	0	600-107	0
116-C-6	0	118-B-9	0	100-K-30	0	1607-D2:3	0
116-C-5	0	116-B-2	0	100-K-32	0	116-F-9	0
116-DR-9	0	100-B-14:7	0	100-F-37	0	100-H-5	0
100-K-56:1	0	116-DR-6	0	100-K-31	0	116-B-12	0
116-DR-7	0	116-B-15	0	100-K-33	0	1607-H2	0
116-D-7	0	100-D-4	0	128-C-1	0	122-DR-1:2	0
100-F-35	0	100-B-8:2	0	600-128	0	100-F-19:1	0
116-K-1	0	116-DR-1&2	0	600-131	0	600-259	0
1607-H4	0	618-4	0	100-F-4	0	1607-D2:4	0
116-C-1	0	600-47	0	100-D-48:1	0	116-B-9	0
100-D-49:4	0	618-5	0	100-F-24	0	600-23	0
116-H-1	0	300-8	0	100-H-17	0	128-K-1	0
116-D-1A	0	300-18	0	1607-B7	0	100-F-26:1	0
1607-F2	0	100-D-48:3	0	128-B-2	0	1607-D4	0
116-KW-3	0	116-H-7	0	116-F-1	0	300 ASH PITS	0
300-50	0	100-C-3	0	100-H-21	0	100-F-38	0
100-F-25	0	100-B-14:3	0	100-D-22	0	300-10	0
116-D-4	0	1607-B11	0	1607-B9	0	100-F-12	0
100-D-20	0	100-C-9:3	0	116-B-10	0	100-B-11	0
100-F-2	0	1607-F6	0	118-C-2	0	118-C-4	0
1607-B8	0	100-F-16	0	100-F-26:5	0	100-F-7	0
116-F-11	0	100-F-11	0	100-B-14:5	0	100-F-9	0
116-F-10	0	100-D-12	0	100-B-5	0	100-F-26:2	0
618-12	0	100-F-15	0	100-F-19:2	0	100-F-18	0
116-K-2	0	100-D-48:4	0	116-DR-4	0	300 VTS	0
118-DR-2:2	0	120-N-1	0	300-49	0	300-45	0
116-KE-4	0	116-KE-5	0	116-D-9	0	100-F-14	0
116-F-3	0	116-KW-4	0	116-F-5	0		

Table 5-35a. CTUIR Scenario "Local Area Only" Total Child Hazard Index Results.

Waste Site ID	child HI	Waste Site ID	child HI	Waste Site ID	child HI	Waste Site ID	child HI
100-K-33	4E+03	116-C-2A	9E+01	116-B-14	9E+01	300-50	9E+01
128-C-1	7E+02	100-F-25	9E+01	100-D-20	9E+01	600-190	9E+01
100-K-30	7E+02	116-B-11	9E+01	116-DR-1&2	9E+01	128-B-2	9E+01
100-K-32	5E+02	JA JONES	9E+01	116-K-1	9E+01	116-F-14	9E+01
300-10	4E+02	1607-B9	9E+01	100-D-48:1	9E+01	122-DR-1:2	9E+01
100-K-31	3E+02	UPR-100-F-2	9E+01	116-F-11	9E+01	1607-D2:1	9E+01
316-2	2E+02	100-D-49:4	9E+01	116-F-6	9E+01	600-131	9E+01
316-1	2E+02	100-F-23	9E+01	116-F-3	9E+01	116-KW-4	9E+01
300 ASH PITS	2E+02	118-C-2	9E+01	116-F-2	9E+01	100-F-26:1	9E+01
100-F-37	2E+02	100-F-16	9E+01	100-F-15	9E+01	100-B-14:5	9E+01
118-B-9	1E+02	116-B-6A	9E+01	100-F-4	9E+01	600-47	9E+01
1607-H2	1E+02	116-DR-9	9E+01	116-F-9	9E+01	100-B-16	9E+01
100-B-14:6	1E+02	116-D-4	9E+01	100-F-11	9E+01	118-B-5	9E+01
618-4	1E+02	118-B-4	9E+01	116-F-7	9E+01	100-F-9	8E+01
100-H-21	1E+02	118-B-10	9E+01	1607-F2	9E+01	618-12	8E+01
600-23	1E+02	100-B-8:1	9E+01	100-F-19:1	9E+01	128-K-1	8E+01
1607-B8	1E+02	100-F-24	9E+01	1607-D2:3	9E+01	100-F-26:5	8E+01
1607-H4	1E+02	100-D-21	9E+01	600-259	9E+01	628-1	8E+01
116-B-10	1E+02	116-B-13	9E+01	100-B-5	9E+01	600-128	8E+01
100-F-38	1E+02	100-D-12	9E+01	116-B-1	9E+01	300-18	8E+01
120-N-1	1E+02	1607-D2:4	9E+01	100-B-8:2	9E+01	100-K-29	8E+01
116-B-15	1E+02	116-C-5	9E+01	116-B-4	9E+01	100-F-26:7	8E+01
116-H-1	1E+02	118-DR-2:2	9E+01	116-B-12	9E+01	600-132	8E+01
100-B-14:7	1E+02	100-H-24	9E+01	116-B-2	9E+01	100-F-12	8E+01
116-KE-5	1E+02	116-D-1A	9E+01	100-F-19:2	9E+01	100-F-14	8E+01
600-181	1E+02	100-D-48:3	9E+01	100-D-52	9E+01	100-F-7	8E+01
116-B-3	1E+02	116-D-2	9E+01	116-D-7	9E+01	600-232	8E+01
116-C-6	1E+02	116-F-10	9E+01	100-F-2	9E+01	300-49	8E+01
116-H-7	1E+02	116-D-9	9E+01	116-N-3	9E+01	128-F-1	8E+01
118-B-3	1E+02	116-DR-4	9E+01	100-F-35	9E+01	116-F-5	7E+01
118-C-4	1E+02	116-DR-6	9E+01	300-8	9E+01	628-4	7E+01
1607-B11	1E+02	116-DR-7	9E+01	618-5	9E+01	100-F-26:2	7E+01
116-B-9	1E+02	100-D-48:4	9E+01	100-B-11	9E+01	100-F-18	7E+01
1607-B10	1E+02	100-D-48:2	9E+01	300 VTS	9E+01	600-233	7E+01
600-204	1E+02	100-D-49:2	9E+01	100-H-17	9E+01	116-F-4	6E+01
116-F-1	1E+02	116-KE-4	9E+01	100-C-9:3	9E+01	316-5	3E+01
100-H-5	9E+01	116-C-1	9E+01	100-B-14:3	9E+01	300-45	3E+01
100-D-22	9E+01	116-K-2	9E+01	600-107	9E+01	300-50	9E+01
116-B-7	9E+01	116-KW-3	9E+01	1607-B7	9E+01	600-190	9E+01
116-B-6B	9E+01	100-K-56:1	9E+01	600-235	9E+01	128-B-2	9E+01
1607-D4	9E+01	100-K-55:1	9E+01	100-C-3	9E+01		

Table 5-35b. CTUIR Scenario
"Local and Broad Areas" Total Child Hazard Index Results.

Waste Site ID	child HI	Waste Site ID	child HI	Waste Site ID	child HI	Waste Site ID	child HI
100-K-33	3E+02	100-D-49:4	3E+02	116-K-2	3E+02	100-F-2	3E+02
128-C-1	3E+02	116-D-4	3E+02	116-KW-3	3E+02	100-F-26:5	3E+02
600-23	3E+02	100-H-24	3E+02	116-C-5	3E+02	100-F-38	3E+02
618-4	3E+02	128-B-2	3E+02	100-K-56:1	3E+02	116-C-6	3E+02
300-10	3E+02	116-F-1	3E+02	100-K-55:1	3E+02	600-131	3E+02
1607-B8	3E+02	100-C-3	3E+02	116-C-1	3E+02	116-N-3	3E+02
600-181	3E+02	100-F-24	3E+02	116-DR-1&2	3E+02	100-K-31	3E+02
316-1	3E+02	118-B-4	3E+02	116-K-1	3E+02	100-F-35	3E+02
118-C-4	3E+02	1607-D2:1	3E+02	100-D-48:1	3E+02	100-B-14:6	3E+02
628-4	3E+02	300-49	3E+02	116-F-3	3E+02	1607-D4	3E+02
600-190	3E+02	116-B-10	3E+02	100-F-19:2	3E+02	300-8	3E+02
600-204	3E+02	1607-D2:4	3E+02	100-B-5	3E+02	116-F-4	3E+02
316-2	3E+02	100-F-25	3E+02	116-F-11	3E+02	100-K-29	3E+02
100-K-30	3E+02	116-DR-9	3E+02	116-B-4	3E+02	300 VTS	3E+02
300 ASH PITS	3E+02	100-H-17	3E+02	116-F-2	3E+02	600-235	3E+02
100-F-37	3E+02	100-D-21	3E+02	116-F-6	3E+02	628-1	3E+02
100-K-32	3E+02	UPR-100-F-2	3E+02	116-B-14	3E+02	300-18	3E+02
116-H-7	3E+02	116-B-9	3E+02	1607-D2:3	3E+02	128-K-1	3E+02
100-H-21	3E+02	116-B-13	3E+02	116-B-1	3E+02	100-F-26:7	3E+02
100-D-4	3E+02	116-KE-4	3E+02	100-F-15	3E+02	100-C-9:3	3E+02
1607-H4	3E+02	118-DR-2:2	3E+02	100-F-4	3E+02	100-B-14:3	3E+02
1607-H2	3E+02	116-F-10	3E+02	116-B-12	3E+02	600-107	3E+02
1607-F6	3E+02	116-B-3	3E+02	100-F-11	3E+02	100-B-16	3E+02
118-F-8:1	3E+02	100-D-12	3E+02	116-F-9	3E+02	100-B-11	3E+02
300-50	3E+02	118-B-3	3E+02	100-F-19:1	3E+02	100-F-26:1	3E+02
100-D-22	3E+02	100-D-20	3E+02	100-B-8:2	3E+02	600-132	3E+02
118-B-9	3E+02	116-B-7	3E+02	116-B-2	3E+02	600-232	3E+02
1607-B11	3E+02	116-C-2A	3E+02	1607-F2	3E+02	128-F-1	3E+02
1607-B10	3E+02	116-B-11	3E+02	116-F-7	3E+02	100-F-12	3E+02
100-B-14:7	3E+02	116-B-6A	3E+02	116-D-7	3E+02	600-233	3E+02
116-H-1	3E+02	100-B-8:1	3E+02	100-D-52	3E+02	100-B-14:5	3E+02
100-F-23	3E+02	100-D-48:4	3E+02	600-259	3E+02	100-F-9	3E+02
618-12	3E+02	100-D-48:3	3E+02	618-5	3E+02	120-N-1	3E+02
118-C-2	3E+02	116-D-1A	3E+02	116-KE-5	3E+02	100-F-7	3E+02
1607-B9	3E+02	116-D-2	3E+02	116-B-15	3E+02	100-F-14	3E+02
100-F-16	3E+02	116-DR-7	3E+02	600-128	3E+02	100-F-26:2	3E+02
116-B-6B	3E+02	116-D-9	3E+02	122-DR-1:2	3E+02	116-F-5	3E+02
JA JONES	3E+02	116-DR-4	3E+02	116-F-14	3E+02	100-F-18	3E+02
118-B-10	3E+02	116-DR-6	3E+02	116-KW-4	3E+02	316-5	3E+02
1607-B7	3E+02	100-D-48:2	3E+02	118-B-5	3E+02	300-45	3E+02
100-H-5	3E+02	100-D-49:2	3E+02	600-47	3E+02		

Table 5-36a. CTUIR Scenario
"Local Area Only" Child Hazard Index: Ratio of Background and Total HI Values.

Waste Site ID	child HI ratio	Waste Site ID	child HI ratio	Waste Site ID	child HI ratio	Waste Site ID	child HI ratio
100-K-33	1.E-01	118-F-8:1	1	116-KW-3	1	1607-B7	1
128-C-1	7.E-01	1607-F6	1	100-K-56:1	1	600-235	1
100-K-30	7.E-01	100-D-4	1	100-K-55:1	1	100-C-3	1
100-K-32	1.E+00	116-C-2A	1	116-B-14	1	300-50	1
300-10	1.E+00	100-F-25	1	100-D-20	1	600-190	1
100-K-31	1	116-B-11	1	116-DR-1&2	1	128-B-2	1
316-2	1	JA JONES	1	116-K-1	1	116-F-14	1
316-1	1	1607-B9	1	100-D-48:1	1	122-DR-1:2	1
300 ASH PITS	1	UPR-100-F-2	1	116-F-11	1	1607-D2:1	1
100-F-37	1	100-D-49:4	1	116-F-6	1	600-131	1
118-B-9	1	100-F-23	1	116-F-3	1	116-KW-4	1
1607-H2	1	118-C-2	1	116-F-2	1	100-F-26:1	1
100-B-14:6	1	100-F-16	1	100-F-15	1	100-B-14:5	1
618-4	1	116-B-6A	1	100-F-4	1	600-47	1
100-H-21	1	116-DR-9	1	116-F-9	1	100-B-16	1
600-23	1	116-D-4	1	100-F-11	1	118-B-5	1
1607-B8	1	118-B-4	1	116-F-7	1	100-F-9	1
1607-H4	1	118-B-10	1	1607-F2	1	618-12	1
116-B-10	1	100-B-8:1	1	100-F-19:1	1	128-K-1	1
100-F-38	1	100-F-24	1	1607-D2:3	1	100-F-26:5	1
120-N-1	1	100-D-21	1	600-259	1	628-1	1
116-B-15	1	116-B-13	1	100-B-5	1	600-128	1
116-H-1	1	100-D-12	1	116-B-1	1	300-18	1
100-B-14:7	1	1607-D2:4	1	100-B-8:2	1	100-K-29	1
116-KE-5	1	116-C-5	1	116-B-4	1	100-F-26:7	1
600-181	1	118-DR-2:2	1	116-B-12	1	600-132	1
116-B-3	1	100-H-24	1	116-B-2	1	100-F-12	1
116-C-6	1	116-D-1A	1	100-F-19:2	1	100-F-14	1
116-H-7	1	100-D-48:3	1	100-D-52	1	100-F-7	1
118-B-3	1	116-D-2	1	116-D-7	1	600-232	1
118-C-4	1	116-F-10	1	100-F-2	1	300-49	1
1607-B11	1	116-D-9	1	116-N-3	1	128-F-1	1
116-B-9	1	116-DR-4	1	100-F-35	1	116-F-5	1
1607-B10	1	116-DR-6	1	300-8	1	628-4	1
600-204	1	116-DR-7	1	618-5	1	100-F-26:2	1
116-F-1	1	100-D-48:4	1	100-B-11	1	100-F-18	1
100-H-5	1	100-D-48:2	1	300 VTS	1	600-233	1
100-D-22	1	100-D-49:2	1	100-H-17	1	116-F-4	1
116-B-7	1	116-KE-4	1	100-C-9:3	1	316-5	1
116-B-6B	1	116-C-1	1	100-B-14:3	1	300-45	1
1607-D4	1	116-K-2	1	600-107	1		

Table 5-36b. CTUIR Scenario "Local and Broad Areas" Child Hazard Index: Ratio of Background and Total HI Values.

Waste Site ID	child HI ratio	Waste Site ID	child HI ratio	Waste Site ID	child HI ratio	Waste Site ID	child HI ratio
100-K-33	8.E-01	100-D-49:4	8.E-01	116-K-2	8.E-01	100-F-2	8.E-01
128-C-1	8.E-01	116-D-4	8.E-01	116-KW-3	8.E-01	100-F-26:5	8.E-01
600-23	8.E-01	100-H-24	8.E-01	116-C-5	8.E-01	100-F-38	8.E-01
618-4	8.E-01	128-B-2	8.E-01	100-K-56:1	8.E-01	116-C-6	8.E-01
300-10	8.E-01	116-F-1	8.E-01	100-K-55:1	8.E-01	600-131	8.E-01
1607-B8	8.E-01	100-C-3	8.E-01	116-C-1	8.E-01	116-N-3	8.E-01
600-181	8.E-01	100-F-24	8.E-01	116-DR-1&2	8.E-01	100-K-31	8.E-01
316-1	8.E-01	118-B-4	8.E-01	116-K-1	8.E-01	100-F-35	8.E-01
118-C-4	8.E-01	1607-D2:1	8.E-01	100-D-48:1	8.E-01	100-B-14:6	8.E-01
628-4	8.E-01	300-49	8.E-01	116-F-3	8.E-01	1607-D4	8.E-01
600-190	8.E-01	116-B-10	8.E-01	100-F-19:2	8.E-01	300-8	8.E-01
600-204	8.E-01	1607-D2:4	8.E-01	100-B-5	8.E-01	116-F-4	8.E-01
316-2	8.E-01	100-F-25	8.E-01	116-F-11	8.E-01	100-K-29	8.E-01
100-K-30	8.E-01	116-DR-9	8.E-01	116-B-4	8.E-01	300 VTS	8.E-01
300 ASH PITS	8.E-01	100-H-17	8.E-01	116-F-2	8.E-01	600-235	8.E-01
100-F-37	8.E-01	100-D-21	8.E-01	116-F-6	8.E-01	628-1	8.E-01
100-K-32	8.E-01	UPR-100-F-2	8.E-01	116-B-14	8.E-01	300-18	8.E-01
116-H-7	8.E-01	116-B-9	8.E-01	1607-D2:3	8.E-01	128-K-1	8.E-01
100-H-21	8.E-01	116-B-13	8.E-01	116-B-1	8.E-01	100-F-26:7	8.E-01
100-D-4	8.E-01	116-KE-4	8.E-01	100-F-15	8.E-01	100-C-9:3	8.E-01
1607-H4	8.E-01	118-DR-2:2	8.E-01	100-F-4	8.E-01	100-B-14:3	8.E-01
1607-H2	8.E-01	116-F-10	8.E-01	116-B-12	8.E-01	600-107	8.E-01
1607-F6	8.E-01	116-B-3	8.E-01	100-F-11	8.E-01	100-B-16	8.E-01
118-F-8:1	8.E-01	100-D-12	8.E-01	116-F-9	8.E-01	100-B-11	8.E-01
300-50	8.E-01	118-B-3	8.E-01	100-F-19:1	8.E-01	100-F-26:1	8.E-01
100-D-22	8.E-01	100-D-20	8.E-01	100-B-8:2	8.E-01	600-132	8.E-01
118-B-9	8.E-01	116-B-7	8.E-01	116-B-2	8.E-01	600-232	8.E-01
1607-B11	8.E-01	116-C-2A	8.E-01	1607-F2	8.E-01	128-F-1	8.E-01
1607-B10	8.E-01	116-B-11	8.E-01	116-F-7	8.E-01	100-F-12	8.E-01
100-B-14:7	8.E-01	116-B-6A	8.E-01	116-D-7	8.E-01	600-233	8.E-01
116-H-1	8.E-01	100-B-8:1	8.E-01	100-D-52	8.E-01	100-B-14:5	8.E-01
100-F-23	8.E-01	100-D-48:4	8.E-01	600-259	8.E-01	100-F-9	8.E-01
618-12	8.E-01	100-D-48:3	8.E-01	618-5	8.E-01	120-N-1	8.E-01
118-C-2	8.E-01	116-D-1A	8.E-01	116-KE-5	8.E-01	100-F-7	8.E-01
1607-B9	8.E-01	116-D-2	8.E-01	116-B-15	8.E-01	100-F-14	8.E-01
100-F-16	8.E-01	116-DR-7	8.E-01	600-128	8.E-01	100-F-26:2	8.E-01
116-B-6B	8.E-01	116-D-9	8.E-01	122-DR-1:2	8.E-01	116-F-5	8.E-01
JA JONES	8.E-01	116-DR-4	8.E-01	116-F-14	8.E-01	100-F-18	8.E-01
118-B-10	8.E-01	116-DR-6	8.E-01	116-KW-4	8.E-01	316-5	8.E-01
1607-B7	8.E-01	100-D-48:2	8.E-01	118-B-5	8.E-01	300-45	8.E-01
100-H-5	8.E-01	100-D-49:2	8.E-01	600-47	8.E-01		

Table 5-37a. Resident Monument Worker RME Total Cancer Risk Results.

Waste Site ID	RME Cancer Risk	Waste Site ID	RME Cancer Risk	Waste Site ID	RME Cancer Risk	Waste Site ID	RME Cancer Risk
316-5	3E-03	100-K-55:1	6E-05	116-F-7	5E-05	100-F-19:2	4E-05
116-F-14	1E-03	116-B-13	6E-05	600-47	5E-05	100-D-21	4E-05
316-2	7E-04	100-F-25	6E-05	300-8	5E-05	628-4	4E-05
118-B-3	3E-04	116-F-2	6E-05	100-C-3	5E-05	100-B-14:5	4E-05
116-B-11	2E-04	100-D-52	6E-05	100-D-48:4	5E-05	300-49	4E-05
118-F-8:1	2E-04	116-F-6	6E-05	116-KE-5	5E-05	118-B-5	4E-05
116-B-1	2E-04	118-B-9	6E-05	600-232	5E-05	116-D-9	4E-05
100-D-48:2	2E-04	118-B-4	6E-05	100-D-48:1	5E-05	100-D-49:2	4E-05
100-B-14:6	2E-04	116-B-7	6E-05	100-B-14:3	5E-05	116-D-2	4E-05
118-B-10	2E-04	UPR-100-F-2	6E-05	1607-B10	5E-05	116-B-6B	4E-05
116-B-14	1E-04	1607-D2:1	6E-05	100-B-16	5E-05	600-107	4E-05
116-C-2A	1E-04	100-F-37	6E-05	100-C-9:3	5E-05	116-B-4	4E-05
100-K-56:1	1E-04	100-B-14:7	6E-05	116-KW-4	5E-05	1607-D2:3	4E-05
116-C-5	1E-04	618-4	5E-05	600-131	5E-05	100-F-26:7	4E-05
116-DR-9	1E-04	116-F-4	5E-05	1607-B7	5E-05	116-B-3	4E-05
116-C-6	1E-04	116-B-2	5E-05	116-F-1	5E-05	116-F-9	4E-05
1607-H4	1E-04	116-B-15	5E-05	300-18	5E-05	1607-H2	4E-05
116-D-7	1E-04	116-DR-6	5E-05	100-K-30	5E-05	116-F-5	4E-05
316-1	1E-04	100-D-4	5E-05	628-1	5E-05	100-H-5	4E-05
116-DR-7	1E-04	600-235	5E-05	100-H-17	5E-05	122-DR-1:2	4E-05
116-K-1	9E-05	600-190	5E-05	120-N-1	5E-05	100-F-19:1	4E-05
116-C-1	9E-05	116-B-6A	5E-05	1607-B11	5E-05	600-259	4E-05
116-H-1	9E-05	100-B-8:2	5E-05	1607-F6	5E-05	116-B-9	4E-05
100-D-49:4	9E-05	1607-B8	5E-05	600-128	5E-05	116-B-12	4E-05
100-F-35	8E-05	116-H-7	5E-05	100-K-32	5E-05	1607-D2:4	4E-05
1607-F2	8E-05	600-181	5E-05	100-K-29	5E-05	300 ASH PITS	4E-05
116-KW-3	8E-05	600-204	5E-05	100-D-22	5E-05	128-K-1	4E-05
116-D-1A	8E-05	618-5	5E-05	1607-B9	5E-05	1607-D4	4E-05
300-10	8E-05	128-C-1	5E-05	100-K-31	5E-05	100-F-26:1	4E-05
116-D-4	7E-05	116-DR-1&2	5E-05	600-132	5E-05	100-F-38	4E-05
116-F-11	7E-05	100-D-48:3	5E-05	118-C-2	5E-05	100-B-11	4E-05
300-50	7E-05	618-12	5E-05	128-B-2	5E-05	100-F-12	4E-05
100-F-2	7E-05	100-H-21	5E-05	600-23	5E-05	100-F-7	3E-05
116-F-10	7E-05	100-F-16	5E-05	100-F-24	5E-05	128-F-1	3E-05
116-K-2	7E-05	JA JONES	5E-05	100-F-26:5	5E-05	100-F-9	3E-05
600-233	7E-05	100-D-12	5E-05	118-C-4	4E-05	300 VTS	3E-05
100-D-20	7E-05	100-H-24	5E-05	116-B-10	4E-05	100-F-26:2	3E-05
116-KE-4	6E-05	100-K-33	5E-05	100-B-5	4E-05	100-F-18	3E-05
118-DR-2:2	6E-05	100-F-15	5E-05	116-DR-4	4E-05	100-F-14	3E-05
116-F-3	6E-05	100-F-11	5E-05	100-F-23	4E-05	300-45	3E-05
116-N-3	6E-05	100-F-4	5E-05	100-B-8:1	4E-05		

Table 5-37b. Resident Monument Worker CTE Total Cancer Risk Results.

Waste Site ID	CTE Cancer Risk	Waste Site ID	CTE Cancer Risk	Waste Site ID	CTE Cancer Risk	Waste Site ID	CTE Cancer Risk
316-5	3E-05	618-5	8E-06	1607-B9	8E-06	600-23	7E-06
116-F-14	3E-05	300-8	8E-06	116-DR-6	8E-06	116-F-9	7E-06
316-2	2E-05	600-232	8E-06	1607-F2	8E-06	116-B-10	7E-06
100-D-49:4	2E-05	100-F-16	8E-06	100-B-14:7	8E-06	116-D-2	7E-06
116-C-5	2E-05	100-B-16	8E-06	1607-B11	8E-06	116-D-9	7E-06
116-B-11	1E-05	JA JONES	8E-06	100-B-5	8E-06	100-F-19:1	7E-06
116-B-14	1E-05	118-B-10	8E-06	100-H-21	8E-06	1607-D2:1	7E-06
116-F-11	1E-05	100-H-24	8E-06	100-C-3	8E-06	600-259	7E-06
116-KW-3	1E-05	100-D-12	8E-06	1607-B8	8E-06	116-B-13	7E-06
116-C-6	1E-05	100-F-11	8E-06	100-F-26:7	8E-06	1607-H2	7E-06
100-K-56:1	1E-05	100-F-15	8E-06	1607-B7	8E-06	118-B-5	7E-06
100-F-35	1E-05	100-F-4	8E-06	100-D-48:4	8E-06	116-B-3	7E-06
116-DR-9	1E-05	116-F-7	8E-06	100-D-48:1	8E-06	1607-D2:4	7E-06
116-K-2	1E-05	116-KE-5	8E-06	118-B-9	8E-06	116-B-9	7E-06
116-H-1	1E-05	600-47	8E-06	116-DR-1&2	8E-06	116-B-4	7E-06
100-F-37	9E-06	100-K-33	8E-06	100-D-48:3	8E-06	100-H-5	7E-06
116-N-3	9E-06	100-C-9:3	8E-06	116-F-4	8E-06	122-DR-1:2	7E-06
118-F-8:1	9E-06	100-B-14:3	8E-06	1607-H4	8E-06	116-B-12	7E-06
100-D-48:2	9E-06	600-131	8E-06	116-B-6A	8E-06	100-F-26:1	7E-06
100-K-55:1	9E-06	116-KW-4	8E-06	100-H-17	7E-06	100-F-12	7E-06
116-KE-4	9E-06	600-128	8E-06	116-H-7	7E-06	100-D-21	6E-06
116-B-1	9E-06	628-1	8E-06	1607-F6	7E-06	128-K-1	6E-06
116-F-2	9E-06	116-F-1	8E-06	116-B-15	7E-06	300 ASH PITS	6E-06
118-B-3	9E-06	116-D-7	8E-06	116-DR-7	7E-06	100-B-14:6	6E-06
116-F-10	9E-06	100-D-20	8E-06	100-F-23	7E-06	118-C-4	6E-06
118-DR-2:2	9E-06	100-F-26:5	8E-06	1607-B10	7E-06	100-F-38	6E-06
100-B-8:2	9E-06	300-18	8E-06	100-B-8:1	7E-06	100-B-14:5	6E-06
600-181	9E-06	600-132	8E-06	100-D-4	7E-06	100-B-11	6E-06
116-B-7	8E-06	100-K-30	8E-06	100-F-19:2	7E-06	300-10	6E-06
118-B-4	8E-06	100-K-31	8E-06	100-D-52	7E-06	100-F-9	6E-06
116-F-6	8E-06	316-1	8E-06	100-D-22	7E-06	128-F-1	6E-06
116-C-1	8E-06	128-B-2	8E-06	618-12	7E-06	600-107	6E-06
116-F-3	8E-06	100-K-32	8E-06	100-F-25	7E-06	100-F-7	6E-06
600-204	8E-06	116-B-2	8E-06	300-49	7E-06	300 VTS	5E-06
600-190	8E-06	600-233	8E-06	116-B-6B	7E-06	100-F-18	5E-06
618-4	8E-06	120-N-1	8E-06	100-F-24	7E-06	100-F-26:2	5E-06
100-F-2	8E-06	100-K-29	8E-06	1607-D2:3	7E-06	1607-D4	5E-06
600-235	8E-06	116-K-1	8E-06	628-4	7E-06	116-F-5	5E-06
116-D-1A	8E-06	116-C-2A	8E-06	116-DR-4	7E-06	300-45	5E-06
128-C-1	8E-06	300-50	8E-06	116-D-4	7E-06	100-F-14	5E-06
UPR-100-F-2	8E-06	118-C-2	8E-06	100-D-49:2	7E-06		

Table 5-38a. Resident Monument Worker RME ILCR Results.

Waste Site ID	RME ILCR	Waste Site ID	RME ILCR	Waste Site ID	RME ILCR	Waste Site ID	RME ILCR
316-5	3.E-03	100-K-55:1	3.E-05	116-F-7	2.E-05	100-F-19:2	1.E-05
116-F-14	1.E-03	116-B-13	3.E-05	600-47	2.E-05	100-D-21	1.E-05
316-2	7.E-04	100-F-25	3.E-05	300-8	2.E-05	628-4	1.E-05
118-B-3	3.E-04	116-F-2	3.E-05	100-C-3	2.E-05	100-B-14:5	1.E-05
116-B-11	2.E-04	100-D-52	3.E-05	100-D-48:4	2.E-05	300-49	1.E-05
118-F-8:1	2.E-04	116-F-6	3.E-05	116-KE-5	2.E-05	118-B-5	1.E-05
116-B-1	1.E-04	118-B-9	3.E-05	600-232	2.E-05	116-D-9	1.E-05
100-D-48:2	1.E-04	118-B-4	3.E-05	100-D-48:1	2.E-05	100-D-49:2	1.E-05
100-B-14:6	1.E-04	116-B-7	3.E-05	100-B-14:3	2.E-05	116-D-2	1.E-05
118-B-10	1.E-04	UPR-100-F-2	3.E-05	1607-B10	2.E-05	116-B-6B	1.E-05
116-B-14	1.E-04	1607-D2:1	3.E-05	100-B-16	2.E-05	600-107	1.E-05
116-C-2A	9.E-05	100-F-37	3.E-05	100-C-9:3	2.E-05	116-B-4	1.E-05
100-K-56:1	9.E-05	100-B-14:7	2.E-05	116-KW-4	2.E-05	1607-D2:3	1.E-05
116-C-5	9.E-05	618-4	2.E-05	600-131	2.E-05	100-F-26:7	1.E-05
116-DR-9	8.E-05	116-F-4	2.E-05	1607-B7	2.E-05	116-B-3	1.E-05
116-C-6	8.E-05	116-B-2	2.E-05	116-F-1	2.E-05	116-F-9	1.E-05
1607-H4	8.E-05	116-B-15	2.E-05	300-18	2.E-05	1607-H2	1.E-05
116-D-7	8.E-05	116-DR-6	2.E-05	100-K-30	2.E-05	116-F-5	1.E-05
316-1	7.E-05	100-D-4	2.E-05	628-1	2.E-05	100-H-5	1.E-05
116-DR-7	7.E-05	600-235	2.E-05	100-H-17	2.E-05	122-DR-1:2	1.E-05
116-K-1	6.E-05	600-190	2.E-05	120-N-1	2.E-05	100-F-19:1	1.E-05
116-C-1	6.E-05	116-B-6A	2.E-05	1607-B11	2.E-05	600-259	1.E-05
116-H-1	6.E-05	100-B-8:2	2.E-05	1607-F6	2.E-05	116-B-9	1.E-05
100-D-49:4	6.E-05	1607-B8	2.E-05	600-128	2.E-05	116-B-12	9.E-06
100-F-35	5.E-05	116-H-7	2.E-05	100-K-32	2.E-05	1607-D2:4	9.E-06
1607-F2	5.E-05	600-181	2.E-05	100-K-29	2.E-05	300 ASH PITS	9.E-06
116-KW-3	5.E-05	600-204	2.E-05	100-D-22	2.E-05	128-K-1	9.E-06
116-D-1A	5.E-05	618-5	2.E-05	1607-B9	2.E-05	1607-D4	8.E-06
300-10	5.E-05	128-C-1	2.E-05	100-K-31	2.E-05	100-F-26:1	7.E-06
116-D-4	4.E-05	116-DR-1&2	2.E-05	600-132	2.E-05	100-F-38	6.E-06
116-F-11	4.E-05	100-D-48:3	2.E-05	118-C-2	2.E-05	100-B-11	5.E-06
300-50	4.E-05	618-12	2.E-05	128-B-2	2.E-05	100-F-12	5.E-06
100-F-2	4.E-05	100-H-21	2.E-05	600-23	2.E-05	100-F-7	6.E-07
116-F-10	4.E-05	100-F-16	2.E-05	100-F-24	2.E-05	128-F-1	3.E-07
116-K-2	4.E-05	JA JONES	2.E-05	100-F-26:5	1.E-05	100-F-9	0
600-233	4.E-05	100-D-12	2.E-05	118-C-4	1.E-05	300 VTS	0
100-D-20	4.E-05	100-H-24	2.E-05	116-B-10	1.E-05	100-F-26:2	0
116-KE-4	3.E-05	100-K-33	2.E-05	100-B-5	1.E-05	100-F-18	0
118-DR-2:2	3.E-05	100-F-15	2.E-05	116-DR-4	1.E-05	100-F-14	0
116-F-3	3.E-05	100-F-11	2.E-05	100-F-23	1.E-05	300-45	0
116-N-3	3.E-05	100-F-4	2.E-05	100-B-8:1	1.E-05		

Table 5-38b. Resident Monument Worker CTE ILCR Results.

Waste Site ID	RME ILCR	Waste Site ID	RME ILCR	Waste Site ID	RME ILCR	Waste Site ID	RME ILCR
316-5	3.E-05	618-5	2.E-06	1607-B9	1.E-06	600-23	6.E-07
116-F-14	2.E-05	300-8	2.E-06	116-DR-6	1.E-06	116-F-9	5.E-07
316-2	1.E-05	600-232	2.E-06	1607-F2	1.E-06	116-B-10	5.E-07
100-D-49:4	9.E-06	100-F-16	2.E-06	100-B-14:7	1.E-06	116-D-2	5.E-07
116-C-5	9.E-06	100-B-16	2.E-06	1607-B11	1.E-06	116-D-9	5.E-07
116-B-11	8.E-06	JA JONES	2.E-06	100-B-5	1.E-06	100-F-19:1	5.E-07
116-B-14	8.E-06	118-B-10	2.E-06	100-H-21	1.E-06	1607-D2:1	5.E-07
116-F-11	7.E-06	100-H-24	2.E-06	100-C-3	1.E-06	600-259	5.E-07
116-KW-3	6.E-06	100-D-12	2.E-06	1607-B8	1.E-06	116-B-13	4.E-07
116-C-6	6.E-06	100-F-11	2.E-06	100-F-26:7	1.E-06	1607-H2	4.E-07
100-K-56:1	5.E-06	100-F-15	2.E-06	1607-B7	1.E-06	118-B-5	4.E-07
100-F-35	4.E-06	100-F-4	2.E-06	100-D-48:4	1.E-06	116-B-3	3.E-07
116-DR-9	4.E-06	116-F-7	2.E-06	100-D-48:1	1.E-06	1607-D2:4	3.E-07
116-K-2	4.E-06	116-KE-5	2.E-06	118-B-9	1.E-06	116-B-9	3.E-07
116-H-1	3.E-06	600-47	2.E-06	116-DR-1&2	1.E-06	116-B-4	3.E-07
100-F-37	3.E-06	100-K-33	2.E-06	100-D-48:3	1.E-06	100-H-5	3.E-07
116-N-3	3.E-06	100-C-9:3	2.E-06	116-F-4	1.E-06	122-DR-1:2	3.E-07
118-F-8:1	3.E-06	100-B-14:3	2.E-06	1607-H4	1.E-06	116-B-12	2.E-07
100-D-48:2	3.E-06	600-131	2.E-06	116-B-6A	1.E-06	100-F-26:1	2.E-07
100-K-55:1	3.E-06	116-KW-4	2.E-06	100-H-17	1.E-06	100-F-12	1.E-07
116-KE-4	3.E-06	600-128	2.E-06	116-H-7	1.E-06	100-D-21	2.E-08
116-B-1	2.E-06	628-1	2.E-06	1607-F6	1.E-06	128-K-1	0
116-F-2	2.E-06	116-F-1	2.E-06	116-B-15	1.E-06	300 ASH PITS	0
118-B-3	2.E-06	116-D-7	2.E-06	116-DR-7	9.E-07	100-B-14:6	0
116-F-10	2.E-06	100-D-20	2.E-06	100-F-23	9.E-07	118-C-4	0
118-DR-2:2	2.E-06	100-F-26:5	2.E-06	1607-B10	9.E-07	100-F-38	0
100-B-8:2	2.E-06	300-18	2.E-06	100-B-8:1	9.E-07	100-B-14:5	0
600-181	2.E-06	600-132	2.E-06	100-D-4	9.E-07	100-B-11	0
116-B-7	2.E-06	100-K-30	2.E-06	100-F-19:2	9.E-07	300-10	0
118-B-4	2.E-06	100-K-31	2.E-06	100-D-52	9.E-07	100-F-9	0
116-F-6	2.E-06	316-1	2.E-06	100-D-22	8.E-07	128-F-1	0
116-C-1	2.E-06	128-B-2	2.E-06	618-12	8.E-07	600-107	0
116-F-3	2.E-06	100-K-32	2.E-06	100-F-25	8.E-07	100-F-7	0
600-204	2.E-06	116-B-2	2.E-06	300-49	8.E-07	300 VTS	0
600-190	2.E-06	600-233	2.E-06	116-B-6B	8.E-07	100-F-18	0
618-4	2.E-06	120-N-1	2.E-06	100-F-24	7.E-07	100-F-26:2	0
100-F-2	2.E-06	100-K-29	2.E-06	1607-D2:3	7.E-07	1607-D4	0
600-235	2.E-06	116-K-1	2.E-06	628-4	7.E-07	116-F-5	0
116-D-1A	2.E-06	116-C-2A	2.E-06	116-DR-4	6.E-07	300-45	0
128-C-1	2.E-06	300-50	2.E-06	116-D-4	6.E-07	100-F-14	0
UPR-100-F-2	2.E-06	118-C-2	2.E-06	100-D-49:2	6.E-07		

Table 5-39a. Resident Monument Worker RME Total Radiation Dose Results.

Waste Site ID	RME Dose (mrem/yr)	Waste Site ID	RME Dose (mrem/yr)	Waste Site ID	RME Dose (mrem/yr)	Waste Site ID	RME Dose (mrem/yr)
316-5	2E+02	116-B-13	3E+00	116-F-7	2E+00	100-F-23	2E+00
116-F-14	6E+01	116-F-2	3E+00	628-1	2E+00	100-D-21	2E+00
316-2	4E+01	100-D-52	3E+00	600-235	2E+00	116-D-9	2E+00
118-B-3	2E+01	118-B-4	3E+00	600-233	2E+00	300-49	2E+00
116-B-11	1E+01	116-F-6	3E+00	600-232	2E+00	100-F-26:7	2E+00
118-F-8:1	1E+01	116-B-7	3E+00	600-204	2E+00	100-D-49:2	2E+00
116-B-1	9E+00	1607-D2:1	3E+00	600-190	2E+00	116-D-2	2E+00
100-D-48:2	9E+00	118-B-9	3E+00	600-181	2E+00	600-107	2E+00
100-B-14:6	8E+00	UPR-100-F-2	3E+00	600-132	2E+00	116-B-4	2E+00
118-B-10	8E+00	116-F-4	3E+00	600-131	2E+00	116-B-6B	2E+00
116-B-14	7E+00	100-B-14:7	3E+00	600-128	2E+00	628-4	2E+00
116-C-2A	6E+00	116-B-2	3E+00	128-C-1	2E+00	1607-D2:3	2E+00
100-K-56:1	6E+00	1607-B8	3E+00	100-K-33	2E+00	116-B-3	2E+00
116-C-5	6E+00	116-DR-6	3E+00	100-K-32	2E+00	116-F-9	2E+00
116-DR-9	6E+00	116-B-15	2E+00	100-K-31	2E+00	122-DR-1:2	2E+00
116-C-6	6E+00	100-D-4	2E+00	100-K-30	2E+00	100-H-5	2E+00
316-1	6E+00	116-B-6A	2E+00	100-K-29	2E+00	100-F-19:1	2E+00
116-D-7	5E+00	100-B-8:2	2E+00	100-F-37	2E+00	600-259	2E+00
116-DR-7	5E+00	1607-B10	2E+00	100-B-16	2E+00	116-B-12	2E+00
116-K-1	5E+00	618-12	2E+00	100-D-48:4	2E+00	600-23	2E+00
116-C-1	4E+00	618-5	2E+00	100-D-48:1	2E+00	116-B-9	2E+00
1607-H4	4E+00	618-4	2E+00	1607-B7	2E+00	1607-H2	2E+00
100-D-49:4	4E+00	600-47	2E+00	100-H-17	2E+00	1607-D2:4	2E+00
100-F-35	4E+00	100-D-48:3	2E+00	1607-F6	2E+00	128-K-1	2E+00
116-H-1	4E+00	300-8	2E+00	1607-B11	2E+00	100-F-26:1	2E+00
1607-F2	4E+00	116-H-7	2E+00	116-F-1	2E+00	1607-D4	2E+00
116-KW-3	4E+00	116-DR-1&2	2E+00	128-B-2	2E+00	100-F-38	2E+00
116-D-1A	4E+00	100-B-14:3	2E+00	100-F-24	2E+00	300 ASH PITS	2E+00
116-D-4	3E+00	300-18	2E+00	100-D-22	2E+00	100-F-12	2E+00
116-F-11	3E+00	100-C-9:3	2E+00	1607-B9	2E+00	128-F-1	2E+00
100-F-2	3E+00	100-C-3	2E+00	118-C-2	2E+00	100-B-11	2E+00
300-50	3E+00	100-D-12	2E+00	100-H-21	2E+00	118-C-4	2E+00
116-F-10	3E+00	100-F-16	2E+00	100-F-26:5	2E+00	300-10	2E+00
116-K-2	3E+00	120-N-1	2E+00	100-B-14:5	2E+00	100-F-7	1E+00
100-D-20	3E+00	116-KW-4	2E+00	116-B-10	2E+00	100-F-9	1E+00
100-F-25	3E+00	116-KE-5	2E+00	100-B-5	2E+00	100-F-26:2	1E+00
118-DR-2:2	3E+00	100-F-11	2E+00	116-DR-4	2E+00	100-F-18	1E+00
116-F-3	3E+00	100-F-15	2E+00	116-F-5	2E+00	300 VTS	1E+00
116-KE-4	3E+00	100-H-24	2E+00	118-B-5	2E+00	100-F-14	1E+00
116-N-3	3E+00	JA JONES	2E+00	100-F-19:2	2E+00	300-45	1E+00
100-K-55:1	3E+00	100-F-4	2E+00	100-B-8:1	2E+00		

Table 5-39b. Resident Monument Worker CTE Total Radiation Dose Results.

Waste Site ID	CTE Dose (mrem/yr)	Waste Site ID	CTE Dose (mrem/yr)	Waste Site ID	CTE Dose (mrem/yr)	Waste Site ID	CTE Dose (mrem/yr)
316-5	7E+00	100-F-16	2E+00	1607-F2	1E+00	100-D-49:2	1E+00
116-F-14	6E+00	120-N-1	2E+00	1607-B9	1E+00	116-F-9	1E+00
316-2	5E+00	116-KW-4	2E+00	1607-B11	1E+00	116-D-2	1E+00
100-D-49:4	3E+00	116-KE-5	2E+00	100-B-5	1E+00	116-B-10	1E+00
116-C-5	3E+00	100-F-11	2E+00	100-B-14:7	1E+00	116-D-9	1E+00
116-B-11	3E+00	100-C-9:3	2E+00	100-C-3	1E+00	100-F-19:1	1E+00
116-B-14	3E+00	100-H-24	2E+00	100-F-26:7	1E+00	600-259	1E+00
116-F-11	3E+00	JA JONES	2E+00	316-1	1E+00	116-B-13	1E+00
116-KW-3	2E+00	100-B-14:3	2E+00	116-F-4	1E+00	118-B-5	1E+00
116-C-6	2E+00	100-F-4	2E+00	1607-B8	1E+00	600-23	1E+00
100-K-56:1	2E+00	100-F-15	2E+00	1607-B7	1E+00	100-H-5	1E+00
100-F-35	2E+00	116-F-7	2E+00	100-D-48:4	1E+00	116-B-4	1E+00
116-DR-9	2E+00	628-1	2E+00	118-B-9	1E+00	116-B-3	1E+00
116-K-2	2E+00	600-235	2E+00	100-D-48:1	1E+00	1607-H2	1E+00
116-H-1	2E+00	600-233	2E+00	100-D-48:3	1E+00	1607-D2:4	1E+00
116-N-3	2E+00	600-232	2E+00	116-DR-1&2	1E+00	116-B-9	1E+00
118-F-8:1	2E+00	600-204	2E+00	100-H-21	1E+00	122-DR-1:2	1E+00
100-D-48:2	2E+00	600-190	2E+00	100-H-17	1E+00	100-F-26:1	1E+00
100-K-55:1	2E+00	600-181	2E+00	116-B-6A	1E+00	100-F-12	1E+00
116-KE-4	2E+00	600-132	2E+00	1607-F6	1E+00	116-B-12	1E+00
116-B-1	2E+00	600-131	2E+00	116-H-7	1E+00	100-D-21	1E+00
116-F-2	2E+00	600-128	2E+00	116-DR-7	1E+00	300 ASH PITS	1E+00
118-B-3	2E+00	128-C-1	2E+00	100-B-8:1	1E+00	128-K-1	1E+00
118-DR-2:2	2E+00	100-K-33	2E+00	100-F-23	1E+00	100-F-38	1E+00
116-F-10	2E+00	100-K-32	2E+00	1607-B10	1E+00	100-B-14:6	1E+00
100-B-8:2	2E+00	100-K-31	2E+00	100-F-19:2	1E+00	100-B-14:5	1E+00
116-B-7	2E+00	100-K-30	2E+00	1607-H4	1E+00	100-B-11	1E+00
118-B-4	2E+00	100-K-29	2E+00	100-D-4	1E+00	118-C-4	1E+00
116-C-1	2E+00	100-F-37	2E+00	618-12	1E+00	300-10	1E+00
116-F-6	2E+00	100-B-16	2E+00	100-D-52	1E+00	128-F-1	1E+00
116-F-3	2E+00	100-F-26:5	2E+00	116-B-15	1E+00	100-F-9	1E+00
100-F-2	2E+00	100-D-20	2E+00	100-D-22	1E+00	100-F-7	1E+00
618-4	2E+00	128-B-2	2E+00	300-49	1E+00	100-F-18	1E+00
300-8	2E+00	116-D-7	2E+00	100-F-25	1E+00	600-107	1E+00
600-47	2E+00	116-F-1	2E+00	116-B-6B	1E+00	1607-D4	1E+00
116-D-1A	2E+00	116-B-2	2E+00	628-4	1E+00	100-F-26:2	1E+00
618-5	2E+00	300-50	2E+00	100-F-24	1E+00	300 VTS	1E+00
UPR-100-F-2	2E+00	116-K-1	1E+00	1607-D2:3	1E+00	116-F-5	9E-01
300-18	2E+00	116-C-2A	1E+00	116-DR-4	1E+00	300-45	9E-01
118-B-10	2E+00	118-C-2	1E+00	116-D-4	1E+00	100-F-14	8E-01
100-D-12	2E+00	116-DR-6	1E+00	1607-D2:1	1E+00		

Table 5-40a. Resident Monument Worker RME Incremental Radiation Dose Results.

Waste Site ID	RME Dose (mrem/yr)	Waste Site ID	RME Dose (mrem/yr)	Waste Site ID	RME Dose (mrem/yr)	Waste Site ID	RME Dose (mrem/yr)
316-5	1.E+02	116-B-13	2.E+00	116-F-7	8.E-01	100-F-23	6.E-01
116-F-14	6.E+01	116-F-2	1.E+00	600-132	8.E-01	100-D-21	6.E-01
316-2	4.E+01	100-D-52	1.E+00	600-204	8.E-01	116-D-9	5.E-01
118-B-3	1.E+01	118-B-4	1.E+00	600-181	8.E-01	300-49	5.E-01
116-B-11	9.E+00	116-F-6	1.E+00	600-232	8.E-01	100-F-26:7	5.E-01
118-F-8:1	9.E+00	116-B-7	1.E+00	600-235	8.E-01	100-D-49:2	5.E-01
116-B-1	8.E+00	1607-D2:1	1.E+00	600-190	8.E-01	116-D-2	5.E-01
100-D-48:2	8.E+00	118-B-9	1.E+00	600-233	8.E-01	600-107	5.E-01
100-B-14:6	7.E+00	UPR-100-F-2	1.E+00	100-B-16	8.E-01	116-B-4	5.E-01
118-B-10	7.E+00	116-F-4	1.E+00	628-1	8.E-01	116-B-6B	5.E-01
116-B-14	6.E+00	100-B-14:7	1.E+00	100-K-29	8.E-01	628-4	5.E-01
116-C-2A	5.E+00	116-B-2	1.E+00	100-K-30	8.E-01	1607-D2:3	5.E-01
100-K-56:1	4.E+00	1607-B8	1.E+00	100-K-32	8.E-01	116-B-3	5.E-01
116-C-5	4.E+00	116-DR-6	1.E+00	100-F-37	8.E-01	116-F-9	4.E-01
116-DR-9	4.E+00	116-B-15	1.E+00	100-K-31	8.E-01	122-DR-1:2	4.E-01
116-C-6	4.E+00	100-D-4	1.E+00	100-K-33	8.E-01	100-H-5	4.E-01
316-1	4.E+00	116-B-6A	1.E+00	128-C-1	8.E-01	100-F-19:1	4.E-01
116-D-7	4.E+00	100-B-8:2	1.E+00	600-128	8.E-01	600-259	4.E-01
116-DR-7	4.E+00	1607-B10	9.E-01	600-131	8.E-01	116-B-12	4.E-01
116-K-1	3.E+00	618-12	9.E-01	100-D-48:4	8.E-01	600-23	4.E-01
116-C-1	3.E+00	618-5	9.E-01	100-D-48:1	8.E-01	116-B-9	4.E-01
1607-H4	3.E+00	618-4	9.E-01	1607-B7	8.E-01	1607-H2	4.E-01
100-D-49:4	3.E+00	600-47	9.E-01	100-H-17	7.E-01	1607-D2:4	3.E-01
100-F-35	3.E+00	100-D-48:3	8.E-01	1607-F6	7.E-01	128-K-1	3.E-01
116-H-1	3.E+00	300-8	8.E-01	1607-B11	7.E-01	100-F-26:1	3.E-01
1607-F2	2.E+00	116-H-7	8.E-01	116-F-1	7.E-01	1607-D4	3.E-01
116-KW-3	2.E+00	116-DR-1&2	8.E-01	128-B-2	7.E-01	100-F-38	3.E-01
116-D-1A	2.E+00	100-B-14:3	8.E-01	100-F-24	7.E-01	300 ASH PITS	2.E-01
116-D-4	2.E+00	300-18	8.E-01	100-D-22	7.E-01	100-F-12	2.E-01
116-F-11	2.E+00	100-C-9:3	8.E-01	1607-B9	7.E-01	128-F-1	2.E-01
100-F-2	2.E+00	100-C-3	8.E-01	118-C-2	7.E-01	100-B-11	2.E-01
300-50	2.E+00	100-D-12	8.E-01	100-H-21	7.E-01	118-C-4	1.E-01
116-F-10	2.E+00	100-F-16	8.E-01	100-F-26:5	7.E-01	300-10	1.E-01
116-K-2	2.E+00	120-N-1	8.E-01	100-B-14:5	6.E-01	100-F-7	0
100-D-20	2.E+00	116-KE-5	8.E-01	116-B-10	6.E-01	100-F-9	0
100-F-25	2.E+00	116-KW-4	8.E-01	100-B-5	6.E-01	100-F-26:2	0
118-DR-2:2	2.E+00	100-F-11	8.E-01	116-DR-4	6.E-01	100-F-18	0
116-F-3	2.E+00	100-F-15	8.E-01	116-F-5	6.E-01	300 VTS	0
116-KE-4	2.E+00	100-H-24	8.E-01	118-B-5	6.E-01	100-F-14	0
116-N-3	2.E+00	JA JONES	8.E-01	100-F-19:2	6.E-01	300-45	0
100-K-55:1	2.E+00	100-F-4	8.E-01	100-B-8:1	6.E-01		

Table 5-40b. Resident Monument Worker CTE Incremental Radiation Dose Results.

Waste Site ID	CTE Dose (mrem/yr)	Waste Site ID	CTE Dose (mrem/yr)	Waste Site ID	CTE Dose (mrem/yr)	Waste Site ID	CTE Dose (mrem/yr)
316-5	6.E+00	100-F-16	3.E-01	1607-F2	3.E-01	100-D-49:2	7.E-02
116-F-14	5.E+00	120-N-1	3.E-01	1607-B9	2.E-01	116-F-9	7.E-02
316-2	3.E+00	116-KE-5	3.E-01	1607-B11	2.E-01	116-D-2	7.E-02
100-D-49:4	2.E+00	116-KW-4	3.E-01	100-B-5	2.E-01	116-B-10	7.E-02
116-C-5	2.E+00	100-F-11	3.E-01	100-B-14:7	2.E-01	116-D-9	7.E-02
116-B-11	2.E+00	100-C-9:3	3.E-01	100-C-3	2.E-01	100-F-19:1	6.E-02
116-B-14	2.E+00	100-H-24	3.E-01	100-F-26:7	2.E-01	600-259	6.E-02
116-F-11	1.E+00	JA JONES	3.E-01	316-1	2.E-01	116-B-13	6.E-02
116-KW-3	1.E+00	100-B-14:3	3.E-01	116-F-4	2.E-01	118-B-5	5.E-02
116-C-6	1.E+00	100-F-4	3.E-01	1607-B8	2.E-01	600-23	4.E-02
100-K-56:1	1.E+00	100-F-15	3.E-01	1607-B7	2.E-01	100-H-5	3.E-02
100-F-35	9.E-01	116-F-7	3.E-01	100-D-48:4	2.E-01	116-B-4	3.E-02
116-DR-9	7.E-01	600-132	3.E-01	118-B-9	2.E-01	116-B-3	3.E-02
116-K-2	7.E-01	100-K-29	3.E-01	100-D-48:1	2.E-01	1607-H2	3.E-02
116-H-1	6.E-01	600-181	3.E-01	100-D-48:3	2.E-01	1607-D2:4	3.E-02
116-N-3	5.E-01	100-K-30	3.E-01	116-DR-1&2	2.E-01	116-B-9	3.E-02
118-F-8:1	5.E-01	600-190	3.E-01	100-H-21	2.E-01	122-DR-1:2	2.E-02
100-D-48:2	5.E-01	100-K-31	3.E-01	100-H-17	2.E-01	100-F-26:1	2.E-02
100-K-55:1	5.E-01	600-204	3.E-01	116-B-6A	2.E-01	100-F-12	1.E-02
116-KE-4	5.E-01	100-K-32	3.E-01	1607-F6	2.E-01	116-B-12	2.E-03
116-B-1	5.E-01	100-F-37	3.E-01	116-H-7	2.E-01	100-D-21	0
116-F-2	4.E-01	100-K-33	3.E-01	116-DR-7	2.E-01	300 ASH PITS	0
118-B-3	4.E-01	100-B-16	3.E-01	100-B-8:1	1.E-01	128-K-1	0
118-DR-2:2	4.E-01	600-232	3.E-01	100-F-23	1.E-01	100-F-38	0
116-F-10	4.E-01	600-233	3.E-01	1607-B10	1.E-01	100-B-14:6	0
100-B-8:2	4.E-01	128-C-1	3.E-01	100-F-19:2	1.E-01	100-B-14:5	0
116-B-7	4.E-01	600-235	3.E-01	1607-H4	1.E-01	100-B-11	0
118-B-4	4.E-01	628-1	3.E-01	100-D-4	1.E-01	118-C-4	0
116-C-1	4.E-01	600-128	3.E-01	618-12	1.E-01	300-10	0
116-F-6	4.E-01	600-131	3.E-01	100-D-52	1.E-01	128-F-1	0
116-F-3	4.E-01	100-F-26:5	3.E-01	116-B-15	1.E-01	100-F-9	0
100-F-2	4.E-01	100-D-20	3.E-01	100-D-22	1.E-01	100-F-7	0
618-4	3.E-01	128-B-2	3.E-01	300-49	1.E-01	100-F-18	0
300-8	3.E-01	116-D-7	3.E-01	100-F-25	1.E-01	600-107	0
600-47	3.E-01	116-F-1	3.E-01	116-B-6B	1.E-01	1607-D4	0
116-D-1A	3.E-01	116-B-2	3.E-01	628-4	1.E-01	100-F-26:2	0
618-5	3.E-01	300-50	3.E-01	100-F-24	1.E-01	300 VTS	0
UPR-100-F-2	3.E-01	116-K-1	3.E-01	1607-D2:3	1.E-01	116-F-5	0
300-18	3.E-01	116-C-2A	3.E-01	116-DR-4	9.E-02	300-45	0
118-B-10	3.E-01	118-C-2	3.E-01	116-D-4	9.E-02	100-F-14	0
100-D-12	3.E-01	116-DR-6	3.E-01	1607-D2:1	8.E-02		

Table 5-41a. Resident Monument Worker RME Total Hazard Index Results.

Waste Site ID	RME HI	Waste Site ID	RME HI	Waste Site ID	RME HI	Waste Site ID	RME HI
100-K-33	7E-01	100-D-49:4	1E-01	100-D-48:2	1E-01	100-F-26:5	1E-01
600-23	6E-01	1607-D2:1	1E-01	116-K-2	1E-01	600-131	1E-01
618-4	6E-01	100-C-3	1E-01	116-KW-3	1E-01	100-F-2	1E-01
128-C-1	4E-01	100-H-24	1E-01	116-C-5	1E-01	116-N-3	1E-01
300-10	4E-01	116-D-4	1E-01	100-K-56:1	1E-01	116-B-15	1E-01
1607-B8	3E-01	100-H-5	1E-01	100-K-55:1	1E-01	116-C-6	1E-01
600-181	3E-01	100-F-24	1E-01	116-C-1	1E-01	116-F-4	1E-01
118-C-4	3E-01	118-B-4	1E-01	116-DR-1&2	1E-01	100-K-31	1E-01
316-1	3E-01	100-H-17	1E-01	116-K-1	1E-01	100-F-35	1E-01
628-4	3E-01	1607-D2:4	1E-01	100-D-48:1	1E-01	100-K-29	1E-01
600-190	2E-01	100-F-25	1E-01	116-F-3	1E-01	100-B-14:6	1E-01
600-204	2E-01	116-DR-9	1E-01	116-F-11	1E-01	1607-D4	1E-01
316-2	2E-01	116-B-10	1E-01	100-B-5	1E-01	300-8	1E-01
100-K-30	2E-01	116-F-1	1E-01	116-F-2	1E-01	300-18	1E-01
300 ASH PITS	2E-01	100-D-21	1E-01	116-F-6	1E-01	628-1	1E-01
116-H-7	2E-01	UPR-100-F-2	1E-01	116-B-4	1E-01	100-F-26:7	1E-01
100-D-4	2E-01	118-DR-2:2	1E-01	116-B-14	1E-01	128-K-1	1E-01
1607-F6	2E-01	116-B-9	1E-01	116-B-1	1E-01	300 VTS	1E-01
118-F-8:1	2E-01	116-B-13	1E-01	100-F-15	1E-01	600-235	1E-01
100-D-22	2E-01	116-KE-4	1E-01	100-F-4	1E-01	100-B-16	1E-01
300-50	2E-01	116-F-10	1E-01	100-F-11	1E-01	100-C-9:3	1E-01
100-K-32	2E-01	100-D-12	1E-01	116-F-9	1E-01	100-B-14:3	1E-01
1607-H4	2E-01	600-128	1E-01	116-B-12	1E-01	600-107	1E-01
1607-H2	2E-01	116-B-3	1E-01	100-F-19:1	1E-01	128-F-1	1E-01
100-F-37	2E-01	118-B-3	1E-01	1607-D2:3	1E-01	100-F-26:1	1E-01
100-H-21	2E-01	100-D-20	1E-01	116-F-7	1E-01	600-232	1E-01
1607-B11	1E-01	116-B-7	1E-01	1607-F2	1E-01	600-132	1E-01
1607-B10	1E-01	116-C-2A	1E-01	100-B-8:2	1E-01	100-B-11	1E-01
100-F-23	1E-01	116-B-11	1E-01	116-B-2	1E-01	100-F-12	1E-01
100-B-14:7	1E-01	116-B-6A	1E-01	116-D-7	1E-01	100-B-14:5	9E-02
118-C-2	1E-01	100-B-8:1	1E-01	600-259	1E-01	100-F-9	9E-02
1607-B9	1E-01	100-F-19:2	1E-01	100-D-52	1E-01	100-F-7	9E-02
100-F-16	1E-01	100-D-48:4	1E-01	618-5	1E-01	300-45	9E-02
1607-B7	1E-01	100-D-48:3	1E-01	118-B-9	1E-01	100-F-14	9E-02
116-B-6B	1E-01	116-D-1A	1E-01	116-KE-5	1E-01	120-N-1	9E-02
118-B-10	1E-01	116-D-2	1E-01	122-DR-1:2	1E-01	100-F-26:2	9E-02
JA JONES	1E-01	116-DR-7	1E-01	116-F-14	1E-01	600-233	9E-02
618-12	1E-01	116-DR-6	1E-01	116-KW-4	1E-01	316-5	9E-02
128-B-2	1E-01	116-DR-4	1E-01	118-B-5	1E-01	116-F-5	9E-02
116-H-1	1E-01	116-D-9	1E-01	600-47	1E-01	100-F-18	8E-02
300-49	1E-01	100-D-49:2	1E-01	100-F-38	1E-01		

Table 5-41b. Resident Monument Worker CTE Total Hazard Index Results.

Waste Site ID	CTE HI	Waste Site ID	CTE HI	Waste Site ID	CTE HI	Waste Site ID	CTE HI
600-181	1E-01	100-D-21	4E-02	100-K-56:1	4E-02	100-F-26:5	4E-02
118-C-4	1E-01	JA JONES	4E-02	100-K-55:1	4E-02	100-K-32	4E-02
600-23	1E-01	118-DR-2:2	4E-02	116-B-7	4E-02	600-47	4E-02
600-204	1E-01	300-49	4E-02	116-DR-1&2	4E-02	116-N-3	4E-02
128-C-1	8E-02	118-B-10	4E-02	116-K-1	4E-02	128-K-1	4E-02
618-4	8E-02	100-D-20	4E-02	100-D-48:1	4E-02	100-B-14:6	4E-02
316-1	7E-02	116-D-4	4E-02	116-F-11	4E-02	118-B-9	4E-02
600-190	7E-02	628-4	4E-02	116-B-4	4E-02	100-F-35	4E-02
316-2	7E-02	128-B-2	4E-02	116-F-3	4E-02	116-C-6	4E-02
100-F-37	7E-02	116-F-1	4E-02	116-F-6	4E-02	300 VTS	4E-02
600-128	5E-02	116-H-1	4E-02	116-F-2	4E-02	300-8	4E-02
100-K-30	5E-02	100-F-24	4E-02	100-B-5	4E-02	628-1	4E-02
118-F-8:1	5E-02	118-B-4	4E-02	116-B-14	4E-02	100-F-12	4E-02
116-H-7	5E-02	1607-D2:1	4E-02	100-F-11	4E-02	100-B-16	4E-02
1607-B8	5E-02	100-F-25	4E-02	116-C-1	4E-02	600-235	4E-02
100-D-22	5E-02	100-C-3	4E-02	100-F-15	4E-02	100-F-38	4E-02
100-H-21	5E-02	UPR-100-F-2	4E-02	100-F-4	4E-02	128-F-1	4E-02
1607-F6	5E-02	116-B-10	4E-02	116-B-12	4E-02	100-C-9:3	4E-02
300 ASH PITS	5E-02	100-H-17	4E-02	116-F-9	4E-02	100-B-14:3	4E-02
1607-H2	5E-02	116-B-9	4E-02	116-F-7	4E-02	600-107	4E-02
1607-H4	5E-02	116-B-13	4E-02	100-B-8:2	4E-02	600-132	4E-02
300-10	5E-02	116-KE-4	4E-02	116-C-5	4E-02	100-K-29	4E-02
100-D-4	5E-02	116-F-10	4E-02	116-B-1	4E-02	100-F-26:7	4E-02
300-50	5E-02	100-D-12	4E-02	1607-F2	4E-02	300-18	4E-02
1607-B11	5E-02	116-B-11	4E-02	116-B-2	4E-02	100-F-9	4E-02
100-B-14:7	5E-02	116-C-2A	4E-02	100-F-19:1	4E-02	100-B-11	4E-02
116-B-15	5E-02	116-D-1A	4E-02	1607-D2:3	4E-02	116-F-4	4E-02
1607-B10	5E-02	100-D-48:3	4E-02	116-D-7	4E-02	600-232	4E-02
618-12	5E-02	116-D-2	4E-02	600-259	4E-02	100-F-26:1	4E-02
1607-B9	5E-02	116-DR-7	4E-02	116-KE-5	4E-02	100-F-7	4E-02
100-H-24	5E-02	100-B-8:1	4E-02	100-D-52	4E-02	100-B-14:5	3E-02
100-D-49:4	5E-02	116-DR-6	4E-02	100-F-19:2	4E-02	100-F-26:2	3E-02
1607-B7	5E-02	116-DR-4	4E-02	118-B-3	4E-02	316-5	3E-02
100-K-33	5E-02	116-D-9	4E-02	618-5	4E-02	100-F-14	3E-02
1607-D2:4	5E-02	100-D-48:4	4E-02	600-131	4E-02	300-45	3E-02
116-DR-9	5E-02	100-D-49:2	4E-02	122-DR-1:2	4E-02	116-F-5	3E-02
100-F-23	5E-02	100-D-48:2	4E-02	116-KW-4	4E-02	1607-D4	3E-02
118-C-2	4E-02	116-B-3	4E-02	100-K-31	4E-02	100-F-18	3E-02
100-H-5	4E-02	116-KW-3	4E-02	116-F-14	4E-02	600-233	3E-02
100-F-16	4E-02	116-K-2	4E-02	118-B-5	4E-02	120-N-1	3E-02
116-B-6B	4E-02	116-B-6A	4E-02	100-F-2	4E-02		

**Table 5-42a. Resident Monument Worker
RME Hazard Index: Ratio of Background and Total HI Values.**

Waste Site ID	RME HI ratio	Waste Site ID	RME HI ratio	Waste Site ID	RME HI ratio	Waste Site ID	RME HI ratio
100-K-33	4.E-01	100-D-49:4	1	100-D-49:2	1	100-F-26:5	1
600-23	4.E-01	1607-D2:1	1	116-K-2	1	600-131	1
618-4	4.E-01	100-C-3	1	116-KW-3	1	100-F-2	1
128-C-1	6.E-01	100-H-24	1	116-C-5	1	116-N-3	1
300-10	7.E-01	116-D-4	1	100-K-56:1	1	116-B-15	1
1607-B8	7.E-01	100-H-5	1	100-K-55:1	1	116-C-6	1
600-181	8.E-01	100-F-24	1	116-C-1	1	116-F-4	1
118-C-4	9.E-01	118-B-4	1	116-DR-1&2	1	100-K-31	1
316-1	1.E+00	100-H-17	1	116-K-1	1	100-F-35	1
628-4	1.E+00	1607-D2:4	1	100-D-48:1	1	100-K-29	1
600-190	1.E+00	100-F-25	1	116-F-3	1	100-B-14:6	1
600-204	1.E+00	116-DR-9	1	116-F-11	1	1607-D4	1
316-2	1.E+00	116-B-10	1	100-B-5	1	300-8	1
100-K-30	1.E+00	116-F-1	1	116-F-2	1	300-18	1
300 ASH PITS	1.E+00	100-D-21	1	116-F-6	1	628-1	1
116-H-7	1.E+00	UPR-100-F-2	1	116-B-4	1	100-F-26:7	1
100-D-4	1	118-DR-2:2	1	116-B-14	1	128-K-1	1
1607-F6	1	116-B-9	1	116-B-1	1	300 VTS	1
118-F-8:1	1	116-B-13	1	100-F-15	1	600-235	1
100-D-22	1	116-KE-4	1	100-F-4	1	100-B-16	1
300-50	1	116-F-10	1	100-F-11	1	100-C-9:3	1
100-K-32	1	100-D-12	1	116-F-9	1	100-B-14:3	1
1607-H4	1	600-128	1	116-B-12	1	600-107	1
1607-H2	1	116-B-3	1	100-F-19:1	1	128-F-1	1
100-F-37	1	118-B-3	1	1607-D2:3	1	100-F-26:1	1
100-H-21	1	100-D-20	1	116-F-7	1	600-232	1
1607-B11	1	116-B-7	1	1607-F2	1	600-132	1
1607-B10	1	116-C-2A	1	100-B-8:2	1	100-B-11	1
100-F-23	1	116-B-11	1	116-B-2	1	100-F-12	1
100-B-14:7	1	116-B-6A	1	116-D-7	1	100-B-14:5	1
118-C-2	1	100-B-8:1	1	600-259	1	100-F-9	1
1607-B9	1	100-F-19:2	1	100-D-52	1	100-F-7	1
100-F-16	1	100-D-48:4	1	618-5	1	300-45	1
1607-B7	1	100-D-48:3	1	118-B-9	1	100-F-14	1
116-B-6B	1	116-D-1A	1	116-KE-5	1	120-N-1	1
118-B-10	1	116-D-2	1	122-DR-1:2	1	100-F-26:2	1
JA JONES	1	116-DR-7	1	116-F-14	1	600-233	1
618-12	1	116-D-9	1	116-KW-4	1	316-5	1
128-B-2	1	116-DR-4	1	118-B-5	1	116-F-5	1
116-H-1	1	116-DR-6	1	600-47	1	100-F-18	1
300-49	1	100-D-48:2	1	100-F-38	1		

**Table 5-42b. Resident Monument Worker
CTE Hazard Index: Ratio of Background and Total HI Values.**

Waste Site ID	CTE HI ratio	Waste Site ID	CTE HI ratio	Waste Site ID	CTE HI ratio	Waste Site ID	CTE HI ratio
600-181	3.E-01	100-D-21	8.E-01	100-K-56:1	9.E-01	100-F-26:5	9.E-01
118-C-4	3.E-01	JA JONES	8.E-01	100-K-55:1	9.E-01	100-K-32	9.E-01
600-23	4.E-01	118-DR-2:2	8.E-01	116-B-7	9.E-01	600-47	9.E-01
600-204	4.E-01	300-49	8.E-01	116-DR-1&2	9.E-01	116-N-3	9.E-01
128-C-1	5.E-01	118-B-10	8.E-01	116-K-1	9.E-01	128-K-1	9.E-01
618-4	5.E-01	100-D-20	8.E-01	100-D-48:1	9.E-01	100-B-14:6	9.E-01
316-1	5.E-01	116-D-4	8.E-01	116-F-11	9.E-01	118-B-9	9.E-01
600-190	5.E-01	628-4	8.E-01	116-B-4	9.E-01	100-F-35	9.E-01
316-2	6.E-01	128-B-2	8.E-01	116-F-3	9.E-01	116-C-6	9.E-01
100-F-37	6.E-01	116-F-1	8.E-01	116-F-6	9.E-01	300 VTS	1.E+00
600-128	7.E-01	116-H-1	8.E-01	116-F-2	9.E-01	300-8	1.E+00
100-K-30	7.E-01	100-F-24	8.E-01	100-B-5	9.E-01	628-1	1.E+00
118-F-8:1	7.E-01	118-B-4	8.E-01	116-B-14	9.E-01	100-F-12	1.E+00
116-H-7	7.E-01	1607-D2:1	8.E-01	100-F-11	9.E-01	100-B-16	1.E+00
1607-B8	7.E-01	100-F-25	8.E-01	116-C-1	9.E-01	600-235	1.E+00
100-D-22	7.E-01	100-C-3	8.E-01	100-F-15	9.E-01	100-F-38	1.E+00
100-H-21	7.E-01	UPR-100-F-2	8.E-01	100-F-4	9.E-01	128-F-1	1.E+00
1607-F6	8.E-01	116-B-10	8.E-01	116-B-12	9.E-01	100-C-9:3	1.E+00
300 ASH PITS	8.E-01	100-H-17	9.E-01	116-F-9	9.E-01	100-B-14:3	1.E+00
1607-H2	8.E-01	116-B-9	9.E-01	116-F-7	9.E-01	600-107	1.E+00
1607-H4	8.E-01	116-B-13	9.E-01	100-B-8:2	9.E-01	600-132	1.E+00
300-10	8.E-01	116-KE-4	9.E-01	116-C-5	9.E-01	100-K-29	1.E+00
100-D-4	8.E-01	116-F-10	9.E-01	116-B-1	9.E-01	100-F-26:7	1.E+00
300-50	8.E-01	100-D-12	9.E-01	1607-F2	9.E-01	300-18	1.E+00
1607-B11	8.E-01	116-B-11	9.E-01	116-B-2	9.E-01	100-F-9	1.E+00
100-B-14:7	8.E-01	116-C-2A	9.E-01	100-F-19:1	9.E-01	100-B-11	1.E+00
116-B-15	8.E-01	116-D-1A	9.E-01	1607-D2:3	9.E-01	116-F-4	1.E+00
1607-B10	8.E-01	100-D-48:3	9.E-01	116-D-7	9.E-01	600-232	1.E+00
618-12	8.E-01	116-D-2	9.E-01	600-259	9.E-01	100-F-26:1	1.E+00
1607-B9	8.E-01	116-DR-7	9.E-01	116-KE-5	9.E-01	100-F-7	1.E+00
100-H-24	8.E-01	100-B-8:1	9.E-01	100-D-52	9.E-01	100-B-14:5	1.E+00
100-D-49:4	8.E-01	116-D-9	9.E-01	100-F-19:2	9.E-01	100-F-26:2	1.E+00
1607-B7	8.E-01	116-DR-4	9.E-01	118-B-3	9.E-01	316-5	1.E+00
100-K-33	8.E-01	116-DR-6	9.E-01	618-5	9.E-01	100-F-14	1.E+00
1607-D2:4	8.E-01	100-D-48:4	9.E-01	600-131	9.E-01	300-45	1.E+00
116-DR-9	8.E-01	100-D-48:2	9.E-01	122-DR-1:2	9.E-01	116-F-5	1.E+00
100-F-23	8.E-01	100-D-49:2	9.E-01	116-KW-4	9.E-01	1607-D4	1.E+00
118-C-2	8.E-01	116-B-3	9.E-01	100-K-31	9.E-01	100-F-18	1.E+00
100-H-5	8.E-01	116-KW-3	9.E-01	116-F-14	9.E-01	600-233	1.E+00
100-F-16	8.E-01	116-K-2	9.E-01	118-B-5	9.E-01	120-N-1	1.E+00
116-B-6B	8.E-01	116-B-6A	9.E-01	100-F-2	9.E-01		

Table 5-43a. Industrial / Commercial RME Total Cancer Risk Results.

Waste Site ID	RME Cancer Risk	Waste Site ID	RME Cancer Risk	Waste Site ID	RME Cancer Risk	Waste Site ID	RME Cancer Risk
316-5	2E-03	116-F-2	3E-05	116-F-7	2E-05	100-D-21	2E-05
116-F-14	1E-03	100-F-25	3E-05	100-K-33	2E-05	100-F-19:2	2E-05
316-2	6E-04	100-D-52	3E-05	100-C-3	2E-05	118-B-5	2E-05
118-B-3	2E-04	118-B-4	3E-05	116-KE-5	2E-05	116-D-9	2E-05
116-B-11	2E-04	116-B-7	3E-05	100-C-9:3	2E-05	300-49	2E-05
118-F-8:1	1E-04	118-B-9	3E-05	100-D-48:4	2E-05	100-D-49:2	2E-05
116-B-1	1E-04	116-F-6	3E-05	600-232	2E-05	116-D-2	2E-05
100-D-48:2	1E-04	UPR-100-F-2	3E-05	116-KW-4	2E-05	600-23	2E-05
100-B-14:6	1E-04	1607-D2:1	3E-05	100-B-16	2E-05	628-4	2E-05
118-B-10	1E-04	300-10	3E-05	600-131	2E-05	600-107	2E-05
116-B-14	1E-04	600-233	3E-05	100-D-48:1	2E-05	116-F-5	2E-05
116-C-2A	8E-05	116-F-4	3E-05	300-18	2E-05	100-F-26:7	2E-05
100-K-56:1	8E-05	100-B-14:7	3E-05	100-K-30	2E-05	116-B-6B	2E-05
116-C-5	8E-05	116-B-2	3E-05	628-1	2E-05	116-B-4	2E-05
116-DR-9	8E-05	116-DR-6	2E-05	120-N-1	2E-05	1607-D2:3	2E-05
116-C-6	7E-05	116-B-15	2E-05	1607-B10	2E-05	116-B-3	2E-05
116-D-7	7E-05	100-D-4	2E-05	100-K-32	2E-05	116-F-9	1E-05
116-DR-7	6E-05	100-F-37	2E-05	600-128	2E-05	1607-H2	1E-05
1607-H4	6E-05	618-4	2E-05	100-K-29	2E-05	100-H-5	1E-05
316-1	6E-05	100-B-8:2	2E-05	100-K-31	2E-05	100-F-19:1	1E-05
116-K-1	6E-05	116-B-6A	2E-05	600-132	2E-05	122-DR-1:2	1E-05
116-C-1	5E-05	600-235	2E-05	1607-B7	2E-05	600-259	1E-05
116-H-1	5E-05	600-190	2E-05	100-H-21	2E-05	116-B-9	1E-05
100-D-49:4	5E-05	116-H-7	2E-05	618-12	2E-05	116-B-12	1E-05
1607-F2	5E-05	618-5	2E-05	100-H-17	2E-05	118-C-4	1E-05
100-F-35	5E-05	100-D-48:3	2E-05	116-F-1	2E-05	1607-D2:4	1E-05
116-KW-3	5E-05	600-181	2E-05	1607-F6	2E-05	128-K-1	1E-05
116-D-1A	4E-05	600-204	2E-05	1607-B11	2E-05	1607-D4	1E-05
116-D-4	4E-05	128-C-1	2E-05	100-D-22	2E-05	300 ASH PITS	1E-05
116-F-11	4E-05	600-47	2E-05	1607-B9	2E-05	100-F-26:1	1E-05
100-F-2	4E-05	300-8	2E-05	128-B-2	2E-05	100-F-38	1E-05
116-F-10	4E-05	100-F-16	2E-05	118-C-2	2E-05	100-F-12	1E-05
116-K-2	4E-05	JA JONES	2E-05	100-F-24	2E-05	100-B-11	1E-05
300-50	4E-05	100-D-12	2E-05	100-F-26:5	2E-05	100-F-7	7E-06
100-D-20	3E-05	1607-B8	2E-05	116-B-10	2E-05	128-F-1	7E-06
116-N-3	3E-05	100-H-24	2E-05	100-B-14:5	2E-05	100-F-9	7E-06
116-KE-4	3E-05	116-DR-1&2	2E-05	100-B-5	2E-05	100-F-26:2	7E-06
118-DR-2:2	3E-05	100-B-14:3	2E-05	116-DR-4	2E-05	300 VTS	6E-06
116-F-3	3E-05	100-F-15	2E-05	100-B-8:1	2E-05	100-F-18	6E-06
100-K-55:1	3E-05	100-F-4	2E-05	100-F-23	2E-05	100-F-14	4E-06
116-B-13	3E-05	100-F-11	2E-05	116-F-7	2E-05		

Table 5-43b. Industrial / Commercial CTE Total Cancer Risk Results.

Waste Site ID	CTE Cancer Risk	Waste Site ID	CTE Cancer Risk	Waste Site ID	CTE Cancer Risk	Waste Site ID	CTE Cancer Risk
316-5	2E-05	600-47	4E-06	1607-F2	4E-06	116-F-9	3E-06
116-F-14	2E-05	600-235	4E-06	1607-B9	4E-06	1607-D2:1	3E-06
316-2	2E-05	128-C-1	4E-06	1607-B11	4E-06	116-B-10	3E-06
100-D-49:4	1E-05	118-B-10	4E-06	100-B-14:7	3E-06	116-D-2	3E-06
116-C-5	1E-05	100-D-12	4E-06	100-B-5	3E-06	116-D-9	3E-06
116-B-11	1E-05	100-F-16	4E-06	100-C-3	3E-06	100-F-19:1	3E-06
116-B-14	1E-05	JA JONES	4E-06	100-F-26:7	3E-06	600-259	3E-06
116-F-11	9E-06	100-H-24	4E-06	1607-B8	3E-06	116-B-13	3E-06
116-KW-3	8E-06	116-KE-5	4E-06	116-F-4	3E-06	600-23	3E-06
116-C-6	7E-06	100-F-15	4E-06	1607-B7	3E-06	118-B-5	3E-06
100-K-56:1	7E-06	100-F-4	4E-06	118-B-9	3E-06	1607-H2	2E-06
100-F-35	6E-06	100-F-11	4E-06	100-D-48:4	3E-06	116-B-3	2E-06
116-DR-9	6E-06	116-F-7	4E-06	100-H-21	3E-06	100-H-5	2E-06
116-K-2	6E-06	100-B-16	4E-06	100-D-48:1	3E-06	1607-D2:4	2E-06
116-H-1	5E-06	100-C-9:3	4E-06	316-1	3E-06	116-B-9	2E-06
116-N-3	5E-06	600-232	4E-06	100-D-48:3	3E-06	116-B-4	2E-06
118-F-8:1	5E-06	100-K-33	4E-06	116-DR-1&2	3E-06	122-DR-1:2	2E-06
100-D-48:2	5E-06	100-B-14:3	4E-06	116-B-6A	3E-06	100-F-26:1	2E-06
100-K-55:1	5E-06	600-131	4E-06	100-H-17	3E-06	100-F-12	2E-06
116-KE-4	5E-06	116-KW-4	4E-06	1607-F6	3E-06	116-B-12	2E-06
116-B-1	4E-06	628-1	4E-06	116-H-7	3E-06	100-D-21	2E-06
116-F-2	4E-06	300-18	4E-06	1607-H4	3E-06	128-K-1	2E-06
100-F-37	4E-06	600-128	4E-06	116-DR-7	3E-06	300 ASH PITS	2E-06
118-B-3	4E-06	600-132	4E-06	100-F-23	3E-06	100-B-14:6	2E-06
116-F-10	4E-06	100-K-30	4E-06	100-B-8:1	3E-06	100-F-38	2E-06
118-DR-2:2	4E-06	100-K-31	4E-06	1607-B10	3E-06	100-B-14:5	2E-06
100-B-8:2	4E-06	100-K-32	4E-06	100-D-4	3E-06	100-B-11	2E-06
116-B-7	4E-06	120-N-1	4E-06	100-F-19:2	3E-06	118-C-4	2E-06
118-B-4	4E-06	100-K-29	4E-06	116-B-15	3E-06	300-10	2E-06
116-F-6	4E-06	100-F-26:5	4E-06	100-D-52	3E-06	100-F-9	1E-06
116-C-1	4E-06	600-233	4E-06	100-D-22	3E-06	128-F-1	1E-06
116-F-3	4E-06	116-D-7	4E-06	100-F-25	3E-06	100-F-7	1E-06
100-F-2	4E-06	100-D-20	4E-06	300-49	3E-06	600-107	1E-06
618-4	4E-06	116-F-1	4E-06	116-B-6B	3E-06	100-F-18	1E-06
600-181	4E-06	128-B-2	4E-06	1607-D2:3	3E-06	100-F-26:2	1E-06
116-D-1A	4E-06	116-B-2	4E-06	100-F-24	3E-06	300 VTS	1E-06
300-8	4E-06	116-K-1	4E-06	628-4	3E-06	1607-D4	1E-06
UPR-100-F-2	4E-06	116-C-2A	4E-06	618-12	3E-06	116-F-5	8E-07
618-5	4E-06	118-C-2	4E-06	116-DR-4	3E-06	300-45	6E-07
600-204	4E-06	116-DR-6	4E-06	116-D-4	3E-06	100-F-14	5E-07
600-190	4E-06	300-50	4E-06	100-D-49:2	3E-06		

Table 5-44a. Industrial / Commercial RME ILCR Results.

Waste Site ID	RME ILCR	Waste Site ID	RME ILCR	Waste Site ID	RME ILCR	Waste Site ID	RME ILCR
316-5	2.E-03	116-F-2	2.E-05	116-F-7	7.E-06	100-F-19:2	4.E-06
116-F-14	1.E-03	100-F-25	2.E-05	100-K-33	7.E-06	118-B-5	4.E-06
316-2	5.E-04	100-D-52	2.E-05	100-C-3	7.E-06	116-D-9	3.E-06
118-B-3	2.E-04	118-B-4	2.E-05	116-KE-5	7.E-06	300-49	3.E-06
116-B-11	1.E-04	116-B-7	2.E-05	100-C-9:3	7.E-06	100-D-49:2	3.E-06
118-F-8:1	1.E-04	118-B-9	2.E-05	100-D-48:4	7.E-06	116-D-2	3.E-06
116-B-1	1.E-04	116-F-6	2.E-05	600-232	7.E-06	600-23	3.E-06
100-D-48:2	1.E-04	UPR-100-F-2	1.E-05	116-KW-4	7.E-06	628-4	3.E-06
100-B-14:6	1.E-04	1607-D2:1	1.E-05	100-B-16	7.E-06	600-107	3.E-06
118-B-10	1.E-04	300-10	1.E-05	600-131	7.E-06	116-F-5	3.E-06
116-B-14	8.E-05	600-233	1.E-05	100-D-48:1	7.E-06	100-F-26:7	3.E-06
116-C-2A	7.E-05	116-F-4	1.E-05	300-18	7.E-06	116-B-6B	3.E-06
100-K-56:1	6.E-05	100-B-14:7	1.E-05	100-K-30	7.E-06	116-B-4	2.E-06
116-C-5	6.E-05	116-B-2	1.E-05	628-1	7.E-06	1607-D2:3	2.E-06
116-DR-9	6.E-05	116-DR-6	1.E-05	120-N-1	7.E-06	116-B-3	2.E-06
116-C-6	6.E-05	116-B-15	1.E-05	1607-B10	7.E-06	116-F-9	2.E-06
116-D-7	5.E-05	100-D-4	1.E-05	100-K-32	7.E-06	1607-H2	1.E-06
116-DR-7	5.E-05	100-F-37	1.E-05	600-128	7.E-06	100-H-5	1.E-06
1607-H4	5.E-05	618-4	1.E-05	100-K-29	7.E-06	100-F-19:1	1.E-06
316-1	5.E-05	100-B-8:2	1.E-05	100-K-31	7.E-06	122-DR-1:2	1.E-06
116-K-1	4.E-05	116-B-6A	1.E-05	600-132	7.E-06	600-259	8.E-07
116-C-1	4.E-05	600-235	9.E-06	1607-B7	7.E-06	116-B-9	7.E-07
116-H-1	4.E-05	600-190	9.E-06	100-H-21	7.E-06	116-B-12	6.E-07
100-D-49:4	4.E-05	116-H-7	8.E-06	618-12	6.E-06	118-C-4	3.E-07
1607-F2	3.E-05	618-5	8.E-06	100-H-17	6.E-06	1607-D2:4	2.E-07
100-F-35	3.E-05	100-D-48:3	8.E-06	116-F-1	6.E-06	128-K-1	0
116-KW-3	3.E-05	600-181	8.E-06	1607-F6	6.E-06	1607-D4	0
116-D-1A	3.E-05	600-204	8.E-06	1607-B11	6.E-06	300 ASH PITS	0
116-D-4	2.E-05	128-C-1	8.E-06	100-D-22	6.E-06	100-F-26:1	0
116-F-11	2.E-05	600-47	8.E-06	1607-B9	6.E-06	100-F-38	0
100-F-2	2.E-05	300-8	8.E-06	128-B-2	6.E-06	100-F-12	0
116-F-10	2.E-05	100-F-16	8.E-06	118-C-2	6.E-06	100-B-11	0
116-K-2	2.E-05	JA JONES	8.E-06	100-F-24	5.E-06	100-F-7	0
300-50	2.E-05	100-D-12	8.E-06	100-F-26:5	5.E-06	128-F-1	0
100-D-20	2.E-05	1607-B8	7.E-06	116-B-10	4.E-06	100-F-9	0
116-N-3	2.E-05	100-H-24	7.E-06	100-B-14:5	4.E-06	100-F-26:2	0
116-KE-4	2.E-05	116-DR-1&2	7.E-06	100-B-5	4.E-06	300 VTS	0
118-DR-2:2	2.E-05	100-B-14:3	7.E-06	116-DR-4	4.E-06	100-F-18	0
116-F-3	2.E-05	100-F-15	7.E-06	100-B-8:1	4.E-06	100-F-14	0
100-K-55:1	2.E-05	100-F-4	7.E-06	100-F-23	4.E-06	300-45	0
116-B-13	2.E-05	100-F-11	7.E-06	100-D-21	4.E-06		

Table 5-44b. Industrial / Commercial CTE ILCR Results.

Waste Site ID	CTE ILCR	Waste Site ID	CTE ILCR	Waste Site ID	CTE ILCR	Waste Site ID	CTE ILCR
316-5	2.E-05	600-47	9.E-07	1607-F2	5.E-07	116-F-9	0
116-F-14	2.E-05	600-235	8.E-07	1607-B9	5.E-07	1607-D2:1	0
316-2	1.E-05	128-C-1	8.E-07	1607-B11	5.E-07	116-B-10	0
100-D-49:4	8.E-06	118-B-10	8.E-07	100-B-14:7	4.E-07	116-D-2	0
116-C-5	7.E-06	100-D-12	8.E-07	100-B-5	4.E-07	116-D-9	0
116-B-11	7.E-06	100-F-16	8.E-07	100-C-3	4.E-07	100-F-19:1	0
116-B-14	7.E-06	JA JONES	8.E-07	100-F-26:7	4.E-07	600-259	0
116-F-11	6.E-06	100-H-24	8.E-07	1607-B8	3.E-07	116-B-13	0
116-KW-3	5.E-06	116-KE-5	8.E-07	116-F-4	3.E-07	600-23	0
116-C-6	4.E-06	100-F-15	8.E-07	1607-B7	3.E-07	118-B-5	0
100-K-56:1	4.E-06	100-F-4	8.E-07	118-B-9	3.E-07	1607-H2	0
100-F-35	3.E-06	100-F-11	8.E-07	100-D-48:4	3.E-07	116-B-3	0
116-DR-9	3.E-06	116-F-7	8.E-07	100-H-21	3.E-07	100-H-5	0
116-K-2	3.E-06	100-B-16	8.E-07	100-D-48:1	3.E-07	1607-D2:4	0
116-H-1	2.E-06	100-C-9:3	8.E-07	316-1	2.E-07	116-B-9	0
116-N-3	2.E-06	600-232	8.E-07	100-D-48:3	2.E-07	116-B-4	0
118-F-8:1	2.E-06	100-K-33	8.E-07	116-DR-1&2	2.E-07	122-DR-1:2	0
100-D-48:2	2.E-06	100-B-14:3	8.E-07	116-B-6A	1.E-07	100-F-26:1	0
100-K-55:1	2.E-06	600-131	8.E-07	100-H-17	1.E-07	100-F-12	0
116-KE-4	2.E-06	116-KW-4	8.E-07	1607-F6	5.E-08	116-B-12	0
116-B-1	1.E-06	628-1	8.E-07	116-H-7	4.E-08	100-D-21	0
116-F-2	1.E-06	300-18	8.E-07	1607-H4	3.E-08	128-K-1	0
100-F-37	1.E-06	600-128	8.E-07	116-DR-7	2.E-08	300 ASH PITS	0
118-B-3	1.E-06	600-132	8.E-07	100-F-23	2.E-09	100-B-14:6	0
116-F-10	1.E-06	100-K-30	8.E-07	100-B-8:1	2.E-09	100-F-38	0
118-DR-2:2	1.E-06	100-K-31	8.E-07	1607-B10	0	100-B-14:5	0
100-B-8:2	1.E-06	100-K-32	7.E-07	100-D-4	0	100-B-11	0
116-B-7	1.E-06	120-N-1	7.E-07	100-F-19:2	0	118-C-4	0
118-B-4	1.E-06	100-K-29	7.E-07	116-B-15	0	300-10	0
116-F-6	1.E-06	100-F-26:5	7.E-07	100-D-52	0	100-F-9	0
116-C-1	1.E-06	600-233	7.E-07	100-D-22	0	128-F-1	0
116-F-3	1.E-06	116-D-7	7.E-07	100-F-25	0	100-F-7	0
100-F-2	1.E-06	100-D-20	7.E-07	300-49	0	600-107	0
618-4	9.E-07	116-F-1	7.E-07	116-B-6B	0	100-F-18	0
600-181	9.E-07	128-B-2	7.E-07	1607-D2:3	0	100-F-26:2	0
116-D-1A	9.E-07	116-B-2	6.E-07	100-F-24	0	300 VTS	0
300-8	9.E-07	116-K-1	6.E-07	628-4	0	1607-D4	0
UPR-100-F-2	9.E-07	116-C-2A	6.E-07	618-12	0	116-F-5	0
618-5	9.E-07	118-C-2	5.E-07	116-DR-4	0	300-45	0
600-204	9.E-07	116-DR-6	5.E-07	116-D-4	0	100-F-14	0
600-190	9.E-07	300-50	5.E-07	100-D-49:2	0		

Table 5-45a. Industrial / Commercial RME Total Radiation Dose Results.

Waste Site ID	RME Dose (mrem/yr)	Waste Site ID	RME Dose (mrem/yr)	Waste Site ID	RME Dose (mrem/yr)	Waste Site ID	RME Dose (mrem/yr)
316-5	1E+02	116-B-13	2E+00	600-235	1E+00	100-D-21	8E-01
116-F-14	5E+01	116-F-2	2E+00	600-233	1E+00	100-F-23	8E-01
316-2	3E+01	100-D-52	1E+00	600-232	1E+00	116-D-9	8E-01
118-B-3	1E+01	118-B-4	1E+00	600-204	1E+00	100-F-26:7	8E-01
116-B-11	8E+00	116-B-7	1E+00	600-190	1E+00	300-49	8E-01
118-F-8:1	8E+00	116-F-6	1E+00	600-181	1E+00	100-D-49:2	8E-01
116-B-1	7E+00	118-B-9	1E+00	600-132	1E+00	600-107	8E-01
100-D-48:2	7E+00	UPR-100-F-2	1E+00	600-131	1E+00	116-D-2	8E-01
100-B-14:6	6E+00	1607-D2:1	1E+00	600-128	1E+00	116-B-6B	8E-01
118-B-10	6E+00	116-F-4	1E+00	128-C-1	1E+00	116-B-4	8E-01
116-B-14	5E+00	100-B-14:7	1E+00	100-K-33	1E+00	628-4	7E-01
116-C-2A	4E+00	116-B-2	1E+00	100-K-32	1E+00	1607-D2:3	7E-01
100-K-56:1	4E+00	116-DR-6	1E+00	100-K-31	1E+00	116-B-3	7E-01
116-C-5	4E+00	116-B-15	1E+00	100-K-30	1E+00	116-F-9	7E-01
116-DR-9	4E+00	100-D-4	1E+00	100-K-29	1E+00	122-DR-1:2	7E-01
116-C-6	4E+00	116-B-6A	1E+00	100-F-37	1E+00	100-F-19:1	7E-01
116-D-7	4E+00	100-B-8:2	1E+00	100-B-16	1E+00	100-H-5	7E-01
316-1	3E+00	1607-B8	1E+00	618-12	1E+00	600-259	7E-01
116-DR-7	3E+00	618-5	1E+00	116-DR-1&2	1E+00	600-23	7E-01
116-K-1	3E+00	618-4	1E+00	100-D-48:4	1E+00	116-B-12	7E-01
116-C-1	3E+00	600-47	1E+00	100-D-48:1	1E+00	116-B-9	7E-01
1607-H4	3E+00	1607-B10	1E+00	1607-B7	1E+00	1607-H2	7E-01
100-D-49:4	3E+00	100-D-48:3	1E+00	100-H-17	1E+00	1607-D2:4	6E-01
116-H-1	3E+00	300-8	1E+00	116-F-1	9E-01	128-K-1	6E-01
100-F-35	2E+00	116-H-7	1E+00	1607-F6	9E-01	100-F-26:1	6E-01
1607-F2	2E+00	100-B-14:3	1E+00	128-B-2	9E-01	1607-D4	6E-01
116-KW-3	2E+00	300-18	1E+00	1607-B11	9E-01	100-F-38	6E-01
116-D-1A	2E+00	100-C-9:3	1E+00	100-D-22	9E-01	300 ASH PITS	6E-01
116-D-4	2E+00	100-C-3	1E+00	1607-B9	9E-01	100-F-12	5E-01
116-F-11	2E+00	100-D-12	1E+00	118-C-2	9E-01	100-B-11	5E-01
100-F-2	2E+00	120-N-1	1E+00	100-F-24	9E-01	118-C-4	5E-01
116-F-10	2E+00	100-F-16	1E+00	100-F-26:5	9E-01	300-10	5E-01
300-50	2E+00	116-KW-4	1E+00	100-H-21	9E-01	128-F-1	4E-01
116-K-2	2E+00	116-KE-5	1E+00	100-B-14:5	9E-01	100-F-7	4E-01
100-D-20	2E+00	100-H-24	1E+00	116-B-10	9E-01	100-F-9	3E-01
118-DR-2:2	2E+00	100-F-15	1E+00	100-B-5	8E-01	100-F-26:2	3E-01
116-KE-4	2E+00	100-F-11	1E+00	116-DR-4	8E-01	100-F-18	3E-01
116-F-3	2E+00	JA JONES	1E+00	118-B-5	8E-01	300 VTS	3E-01
116-N-3	2E+00	100-F-4	1E+00	116-F-5	8E-01	100-F-14	2E-01
100-F-25	2E+00	116-F-7	1E+00	100-F-19:2	8E-01	300-45	2E-01
100-K-55:1	2E+00	628-1	1E+00	100-B-8:1	8E-01		

Table 5-45b. Industrial / Commercial CTE Total Radiation Dose Results.

Waste Site ID	CTE Dose (mrem/yr)	Waste Site ID	CTE Dose (mrem/yr)	Waste Site ID	CTE Dose (mrem/yr)	Waste Site ID	CTE Dose (mrem/yr)
316-5	6E+00	120-N-1	7E-01	1607-F2	7E-01	100-D-49:2	5E-01
116-F-14	5E+00	116-KW-4	7E-01	1607-B9	7E-01	116-F-9	5E-01
316-2	3E+00	116-KE-5	7E-01	1607-B11	7E-01	116-B-10	5E-01
100-D-49:4	2E+00	100-F-16	7E-01	100-B-5	7E-01	116-D-2	5E-01
116-C-5	2E+00	100-C-9:3	7E-01	100-B-14:7	7E-01	116-D-9	5E-01
116-B-11	2E+00	100-H-24	7E-01	100-C-3	7E-01	100-F-19:1	5E-01
116-B-14	2E+00	100-F-11	7E-01	100-F-26:7	7E-01	600-259	5E-01
116-F-11	2E+00	JA JONES	7E-01	116-F-4	7E-01	116-B-13	5E-01
116-KW-3	2E+00	100-F-4	7E-01	1607-B8	6E-01	118-B-5	5E-01
116-C-6	2E+00	100-B-14:3	7E-01	1607-B7	6E-01	600-23	5E-01
100-K-56:1	1E+00	100-F-15	7E-01	118-B-9	6E-01	100-H-5	5E-01
100-F-35	1E+00	116-F-7	7E-01	100-D-48:4	6E-01	116-B-3	5E-01
116-DR-9	1E+00	628-1	7E-01	316-1	6E-01	116-B-4	5E-01
116-K-2	1E+00	600-235	7E-01	100-D-48:1	6E-01	116-B-9	5E-01
116-H-1	1E+00	600-233	7E-01	100-D-48:3	6E-01	1607-D2:4	5E-01
116-N-3	9E-01	600-232	7E-01	116-DR-1&2	6E-01	1607-H2	5E-01
118-F-8:1	9E-01	600-204	7E-01	100-H-21	6E-01	122-DR-1:2	5E-01
100-D-48:2	9E-01	600-190	7E-01	116-B-6A	6E-01	100-F-26:1	5E-01
100-K-55:1	9E-01	600-181	7E-01	100-H-17	6E-01	100-F-12	5E-01
116-KE-4	9E-01	600-132	7E-01	1607-F6	6E-01	116-B-12	4E-01
116-B-1	9E-01	600-131	7E-01	116-H-7	6E-01	100-D-21	4E-01
116-F-2	8E-01	600-128	7E-01	116-DR-7	6E-01	128-K-1	4E-01
118-B-3	8E-01	128-C-1	7E-01	100-B-8:1	6E-01	300 ASH PITS	4E-01
118-DR-2:2	8E-01	100-K-33	7E-01	100-F-23	6E-01	100-F-38	4E-01
116-F-10	8E-01	100-K-32	7E-01	1607-B10	6E-01	100-B-14:6	4E-01
100-B-8:2	8E-01	100-K-31	7E-01	100-F-19:2	6E-01	100-B-14:5	4E-01
116-B-7	8E-01	100-K-30	7E-01	1607-H4	6E-01	100-B-11	3E-01
118-B-4	8E-01	100-K-29	7E-01	100-D-4	6E-01	118-C-4	3E-01
116-C-1	8E-01	100-F-37	7E-01	100-D-52	6E-01	300-10	3E-01
116-F-6	8E-01	100-B-16	7E-01	100-D-22	6E-01	128-F-1	3E-01
116-F-3	8E-01	100-F-26:5	7E-01	116-B-15	6E-01	100-F-9	3E-01
100-F-2	8E-01	100-D-20	7E-01	618-12	6E-01	100-F-7	3E-01
618-4	8E-01	128-B-2	7E-01	300-49	6E-01	100-F-18	3E-01
300-8	8E-01	116-D-7	7E-01	100-F-25	6E-01	600-107	2E-01
116-D-1A	8E-01	116-F-1	7E-01	116-B-6B	5E-01	1607-D4	2E-01
600-47	8E-01	116-B-2	7E-01	1607-D2:3	5E-01	100-F-26:2	2E-01
618-5	8E-01	116-K-1	7E-01	100-F-24	5E-01	300 VTS	2E-01
UPR-100-F-2	8E-01	116-C-2A	7E-01	628-4	5E-01	116-F-5	2E-01
300-18	8E-01	300-50	7E-01	116-DR-4	5E-01	300-45	1E-01
118-B-10	8E-01	118-C-2	7E-01	116-D-4	5E-01	100-F-14	9E-02
100-D-12	7E-01	116-DR-6	7E-01	1607-D2:1	5E-01		

Table 5-46a. Industrial / Commercial RME Incremental Radiation Dose Results.

Waste Site ID	RME Dose (mrem/yr)	Waste Site ID	RME Dose (mrem/yr)	Waste Site ID	RME Dose (mrem/yr)	Waste Site ID	RME Dose (mrem/yr)
316-5	1.E+02	116-B-13	1.E+00	600-204	4.E-01	100-D-21	2.E-01
116-F-14	5.E+01	116-F-2	9.E-01	600-181	4.E-01	100-F-23	2.E-01
316-2	3.E+01	100-D-52	8.E-01	600-232	4.E-01	116-D-9	1.E-01
118-B-3	1.E+01	118-B-4	8.E-01	600-235	4.E-01	100-F-26:7	1.E-01
116-B-11	7.E+00	116-B-7	8.E-01	600-190	4.E-01	300-49	1.E-01
118-F-8:1	7.E+00	116-F-6	8.E-01	600-233	4.E-01	100-D-49:2	1.E-01
116-B-1	6.E+00	118-B-9	8.E-01	100-B-16	4.E-01	600-107	1.E-01
100-D-48:2	6.E+00	UPR-100-F-2	8.E-01	628-1	4.E-01	116-D-2	1.E-01
100-B-14:6	5.E+00	1607-D2:1	7.E-01	100-K-29	4.E-01	116-B-6B	1.E-01
118-B-10	5.E+00	116-F-4	7.E-01	100-K-30	4.E-01	116-B-4	1.E-01
116-B-14	4.E+00	100-B-14:7	6.E-01	100-K-32	4.E-01	628-4	9.E-02
116-C-2A	4.E+00	116-B-2	6.E-01	100-F-37	4.E-01	1607-D2:3	9.E-02
100-K-56:1	3.E+00	116-DR-6	6.E-01	100-K-31	4.E-01	116-B-3	8.E-02
116-C-5	3.E+00	116-B-15	5.E-01	100-K-33	4.E-01	116-F-9	6.E-02
116-DR-9	3.E+00	100-D-4	5.E-01	128-C-1	4.E-01	122-DR-1:2	2.E-02
116-C-6	3.E+00	116-B-6A	5.E-01	600-128	4.E-01	100-F-19:1	2.E-02
116-D-7	3.E+00	100-B-8:2	5.E-01	600-131	4.E-01	100-H-5	2.E-02
316-1	3.E+00	1607-B8	5.E-01	618-12	4.E-01	600-259	8.E-03
116-DR-7	3.E+00	618-5	4.E-01	116-DR-1&2	4.E-01	600-23	8.E-03
116-K-1	2.E+00	618-4	4.E-01	100-D-48:4	4.E-01	116-B-12	4.E-03
116-C-1	2.E+00	600-47	4.E-01	100-D-48:1	3.E-01	116-B-9	9.E-04
1607-H4	2.E+00	1607-B10	4.E-01	1607-B7	3.E-01	1607-H2	0
100-D-49:4	2.E+00	100-D-48:3	4.E-01	100-H-17	3.E-01	1607-D2:4	0
116-H-1	2.E+00	300-8	4.E-01	116-F-1	3.E-01	128-K-1	0
100-F-35	2.E+00	116-H-7	4.E-01	1607-F6	3.E-01	100-F-26:1	0
1607-F2	2.E+00	100-B-14:3	4.E-01	128-B-2	3.E-01	1607-D4	0
116-KW-3	2.E+00	300-18	4.E-01	1607-B11	3.E-01	100-F-38	0
116-D-1A	2.E+00	100-C-9:3	4.E-01	100-D-22	3.E-01	300 ASH PITS	0
116-D-4	1.E+00	100-C-3	4.E-01	1607-B9	3.E-01	100-F-12	0
116-F-11	1.E+00	100-D-12	4.E-01	118-C-2	3.E-01	100-B-11	0
100-F-2	1.E+00	120-N-1	4.E-01	100-F-24	3.E-01	118-C-4	0
116-F-10	1.E+00	100-F-16	4.E-01	100-F-26:5	2.E-01	300-10	0
300-50	1.E+00	116-KE-5	4.E-01	100-H-21	2.E-01	128-F-1	0
116-K-2	1.E+00	116-KW-4	4.E-01	100-B-14:5	2.E-01	100-F-7	0
100-D-20	1.E+00	100-H-24	4.E-01	116-B-10	2.E-01	100-F-9	0
118-DR-2:2	1.E+00	100-F-15	4.E-01	100-B-5	2.E-01	100-F-26:2	0
116-KE-4	1.E+00	100-F-11	4.E-01	116-DR-4	2.E-01	100-F-18	0
116-F-3	1.E+00	JA JONES	4.E-01	118-B-5	2.E-01	300 VTS	0
116-N-3	1.E+00	100-F-4	4.E-01	116-F-5	2.E-01	100-F-14	0
100-F-25	1.E+00	116-F-7	4.E-01	100-F-19:2	2.E-01	300-45	0
100-K-55:1	1.E+00	600-132	4.E-01	100-B-8:1	2.E-01		

Table 5-46b. Industrial / Commercial CTE Incremental Radiation Dose Results.

Waste Site ID	CTE Dose (mrem/yr)	Waste Site ID	CTE Dose (mrem/yr)	Waste Site ID	CTE Dose (mrem/yr)	Waste Site ID	CTE Dose (mrem/yr)
316-5	5.E+00	120-N-1	2.E-01	1607-F2	9.E-02	100-D-49:2	0
116-F-14	4.E+00	116-KE-5	2.E-01	1607-B9	8.E-02	116-F-9	0
316-2	3.E+00	116-KW-4	2.E-01	1607-B11	8.E-02	116-B-10	0
100-D-49:4	2.E+00	100-F-16	2.E-01	100-B-5	8.E-02	116-D-2	0
116-C-5	1.E+00	100-C-9:3	2.E-01	100-B-14:7	8.E-02	116-D-9	0
116-B-11	1.E+00	100-H-24	2.E-01	100-C-3	7.E-02	100-F-19:1	0
116-B-14	1.E+00	100-F-11	2.E-01	100-F-26:7	7.E-02	600-259	0
116-F-11	1.E+00	JA JONES	2.E-01	116-F-4	7.E-02	116-B-13	0
116-KW-3	9.E-01	100-F-4	2.E-01	1607-B8	5.E-02	118-B-5	0
116-C-6	9.E-01	100-B-14:3	2.E-01	1607-B7	5.E-02	600-23	0
100-K-56:1	8.E-01	100-F-15	2.E-01	118-B-9	5.E-02	100-H-5	0
100-F-35	6.E-01	116-F-7	2.E-01	100-D-48:4	5.E-02	116-B-3	0
116-DR-9	5.E-01	600-132	2.E-01	316-1	5.E-02	116-B-4	0
116-K-2	5.E-01	100-K-29	2.E-01	100-D-48:1	5.E-02	116-B-9	0
116-H-1	4.E-01	600-181	2.E-01	100-D-48:3	4.E-02	1607-D2:4	0
116-N-3	4.E-01	100-K-30	2.E-01	116-DR-1&2	4.E-02	1607-H2	0
118-F-8:1	3.E-01	600-190	2.E-01	100-H-21	2.E-02	122-DR-1:2	0
100-D-48:2	3.E-01	100-K-31	2.E-01	116-B-6A	1.E-02	100-F-26:1	0
100-K-55:1	3.E-01	600-204	2.E-01	100-H-17	1.E-02	100-F-12	0
116-KE-4	3.E-01	100-K-32	2.E-01	1607-F6	6.E-04	116-B-12	0
116-B-1	3.E-01	100-F-37	2.E-01	116-H-7	0	100-D-21	0
116-F-2	3.E-01	100-K-33	2.E-01	116-DR-7	0	128-K-1	0
118-B-3	2.E-01	100-B-16	2.E-01	100-B-8:1	0	300 ASH PITS	0
118-DR-2:2	2.E-01	600-232	2.E-01	100-F-23	0	100-F-38	0
116-F-10	2.E-01	600-233	2.E-01	1607-B10	0	100-B-14:6	0
100-B-8:2	2.E-01	128-C-1	2.E-01	100-F-19:2	0	100-B-14:5	0
116-B-7	2.E-01	600-235	2.E-01	1607-H4	0	100-B-11	0
118-B-4	2.E-01	628-1	2.E-01	100-D-4	0	118-C-4	0
116-C-1	2.E-01	600-128	2.E-01	100-D-52	0	300-10	0
116-F-6	2.E-01	600-131	2.E-01	100-D-22	0	128-F-1	0
116-F-3	2.E-01	100-F-26:5	1.E-01	116-B-15	0	100-F-9	0
100-F-2	2.E-01	100-D-20	1.E-01	618-12	0	100-F-7	0
618-4	2.E-01	128-B-2	1.E-01	300-49	0	100-F-18	0
300-8	2.E-01	116-D-7	1.E-01	100-F-25	0	600-107	0
116-D-1A	2.E-01	116-F-1	1.E-01	116-B-6B	0	1607-D4	0
600-47	2.E-01	116-B-2	1.E-01	1607-D2:3	0	100-F-26:2	0
618-5	2.E-01	116-K-1	1.E-01	100-F-24	0	300 VTS	0
UPR-100-F-2	2.E-01	116-C-2A	1.E-01	628-4	0	116-F-5	0
300-18	2.E-01	300-50	1.E-01	116-DR-4	0	300-45	0
118-B-10	2.E-01	118-C-2	1.E-01	116-D-4	0	100-F-14	0
100-D-12	2.E-01	116-DR-6	9.E-02	1607-D2:1	0		

Table 5-47a. Industrial / Commercial RME Total Hazard Index Results.

Waste Site ID	RME HI	Waste Site ID	RME HI	Waste Site ID	RME HI	Waste Site ID	RME HI
100-K-33	3E-01	1607-D2:1	4E-02	100-D-49:2	3E-02	100-F-26:5	3E-02
600-23	2E-01	116-D-4	4E-02	100-D-48:2	3E-02	600-131	3E-02
618-4	2E-01	100-H-5	4E-02	116-KW-3	3E-02	100-F-2	3E-02
128-C-1	2E-01	100-H-24	4E-02	116-K-2	3E-02	116-B-15	3E-02
300-10	1E-01	100-C-3	4E-02	116-C-5	3E-02	116-N-3	3E-02
1607-B8	1E-01	300-49	4E-02	100-K-56:1	3E-02	116-C-6	3E-02
600-181	9E-02	100-F-24	4E-02	100-K-55:1	3E-02	100-K-31	3E-02
118-C-4	9E-02	118-B-4	3E-02	116-C-1	3E-02	100-B-14:6	3E-02
316-1	8E-02	100-H-17	3E-02	116-DR-1&2	3E-02	100-F-35	3E-02
628-4	8E-02	1607-D2:4	3E-02	116-F-3	3E-02	116-F-4	3E-02
600-190	7E-02	100-F-25	3E-02	116-K-1	3E-02	100-K-29	3E-02
600-204	7E-02	116-DR-9	3E-02	100-D-48:1	3E-02	1607-D4	2E-02
100-K-30	6E-02	116-B-10	3E-02	116-F-2	3E-02	300-8	2E-02
316-2	6E-02	116-F-1	3E-02	116-F-11	3E-02	300-18	2E-02
300 ASH PITS	5E-02	100-D-21	3E-02	100-B-5	3E-02	628-1	2E-02
100-K-32	5E-02	UPR-100-F-2	3E-02	116-F-6	3E-02	128-K-1	2E-02
116-H-7	5E-02	118-DR-2:2	3E-02	116-B-4	3E-02	100-F-26:7	2E-02
100-D-4	4E-02	116-B-9	3E-02	116-B-14	3E-02	300 VTS	2E-02
1607-F6	4E-02	100-F-38	3E-02	116-B-1	3E-02	600-235	2E-02
100-F-37	4E-02	116-B-13	3E-02	100-F-15	3E-02	100-B-16	2E-02
118-F-8:1	4E-02	116-KE-4	3E-02	100-F-11	3E-02	100-B-14:3	2E-02
100-D-22	4E-02	118-B-9	3E-02	100-F-4	3E-02	100-C-9:3	2E-02
300-50	4E-02	116-F-10	3E-02	116-F-9	3E-02	600-107	2E-02
1607-H2	4E-02	100-D-12	3E-02	116-B-12	3E-02	100-F-26:1	2E-02
1607-H4	4E-02	116-B-3	3E-02	100-F-19:1	3E-02	100-B-11	2E-02
100-H-21	4E-02	118-B-3	3E-02	116-F-7	3E-02	128-F-1	2E-02
1607-B11	4E-02	100-D-20	3E-02	1607-F2	3E-02	600-232	2E-02
1607-B10	4E-02	116-B-7	3E-02	100-B-8:2	3E-02	600-132	2E-02
100-B-14:7	4E-02	116-C-2A	3E-02	116-B-2	3E-02	100-F-12	2E-02
100-F-23	4E-02	116-B-11	3E-02	1607-D2:3	3E-02	100-B-14:5	2E-02
118-C-2	4E-02	116-B-6A	3E-02	116-D-7	3E-02	100-F-9	2E-02
1607-B9	4E-02	100-F-19:2	3E-02	600-259	3E-02	100-F-7	2E-02
100-F-16	4E-02	100-B-8:1	3E-02	100-D-52	3E-02	100-F-14	2E-02
116-B-6B	4E-02	100-D-48:4	3E-02	600-128	3E-02	120-N-1	2E-02
118-B-10	4E-02	100-D-48:3	3E-02	618-5	3E-02	100-F-26:2	2E-02
1607-B7	4E-02	116-D-1A	3E-02	116-KE-5	3E-02	300-45	2E-02
116-H-1	4E-02	116-D-2	3E-02	122-DR-1:2	3E-02	600-233	2E-02
JA JONES	4E-02	116-DR-7	3E-02	116-F-14	3E-02	116-F-5	2E-02
618-12	4E-02	116-DR-6	3E-02	116-KW-4	3E-02	316-5	2E-02
128-B-2	4E-02	116-DR-4	3E-02	118-B-5	3E-02	100-F-18	1E-02
100-D-49:4	4E-02	116-D-9	3E-02	600-47	3E-02		

Table 5-47b. Industrial / Commercial CTE Total Hazard Index Results.

Waste Site ID	CTE HI	Waste Site ID	CTE HI	Waste Site ID	CTE HI	Waste Site ID	CTE HI
600-181	4E-02	100-H-5	1E-02	116-B-6A	1E-02	116-N-3	1E-02
118-C-4	4E-02	JA JONES	1E-02	100-K-56:1	1E-02	116-F-14	1E-02
600-23	3E-02	116-F-1	1E-02	100-K-55:1	1E-02	118-B-5	1E-02
600-204	3E-02	116-H-1	1E-02	116-B-7	1E-02	600-47	1E-02
128-C-1	3E-02	116-D-4	1E-02	116-DR-1&2	1E-02	100-F-26:5	9E-03
316-1	2E-02	100-K-31	1E-02	116-K-1	1E-02	118-B-9	9E-03
100-F-37	2E-02	100-D-20	1E-02	100-D-48:1	1E-02	128-K-1	9E-03
618-4	2E-02	118-DR-2:2	1E-02	116-F-11	1E-02	100-F-35	9E-03
316-2	2E-02	118-B-10	1E-02	116-F-3	1E-02	300 VTS	9E-03
600-190	2E-02	118-B-4	1E-02	116-B-4	1E-02	300-8	9E-03
100-K-30	2E-02	100-F-24	1E-02	116-F-6	1E-02	116-C-6	9E-03
600-128	1E-02	100-F-25	1E-02	116-F-2	1E-02	628-1	9E-03
118-F-8:1	1E-02	116-B-10	1E-02	116-B-14	1E-02	600-235	9E-03
100-H-21	1E-02	UPR-100-F-2	1E-02	100-F-11	1E-02	100-B-16	9E-03
116-H-7	1E-02	128-B-2	1E-02	100-B-5	1E-02	100-C-9:3	9E-03
300 ASH PITS	1E-02	116-B-9	1E-02	100-F-15	1E-02	100-B-14:3	9E-03
1607-B8	1E-02	100-K-32	1E-02	116-C-1	1E-02	100-F-12	9E-03
100-D-22	1E-02	100-H-17	1E-02	100-F-4	1E-02	600-107	9E-03
1607-H2	1E-02	100-C-3	1E-02	116-B-12	1E-02	100-F-38	8E-03
1607-F6	1E-02	116-B-13	1E-02	116-F-9	1E-02	128-F-1	8E-03
1607-H4	1E-02	116-KE-4	1E-02	116-F-7	1E-02	600-132	8E-03
300-10	1E-02	300-49	1E-02	116-C-5	1E-02	100-B-11	8E-03
116-B-15	1E-02	100-D-12	1E-02	100-B-8:2	1E-02	300-18	8E-03
100-B-14:7	1E-02	116-F-10	1E-02	116-KE-5	1E-02	100-F-9	8E-03
100-D-4	1E-02	1607-D2:1	1E-02	116-B-1	1E-02	100-K-29	8E-03
100-K-33	1E-02	116-B-11	1E-02	1607-F2	1E-02	100-F-26:7	8E-03
1607-B11	1E-02	116-C-2A	1E-02	100-F-19:1	1E-02	600-232	8E-03
1607-B10	1E-02	116-D-1A	1E-02	116-B-2	1E-02	100-F-26:1	8E-03
300-50	1E-02	100-D-48:3	1E-02	1607-D2:3	1E-02	100-F-7	8E-03
100-H-24	1E-02	116-D-2	1E-02	116-D-7	1E-02	100-B-14:5	8E-03
618-12	1E-02	116-DR-7	1E-02	600-259	1E-02	116-F-4	7E-03
1607-B9	1E-02	100-B-8:1	1E-02	100-D-52	1E-02	100-F-26:2	7E-03
100-D-49:4	1E-02	116-DR-6	1E-02	100-F-19:2	1E-02	116-F-5	7E-03
1607-B7	1E-02	116-DR-4	1E-02	618-5	1E-02	100-F-14	7E-03
1607-D2:4	1E-02	116-D-9	1E-02	118-B-3	1E-02	1607-D4	6E-03
116-DR-9	1E-02	100-D-48:4	1E-02	628-4	1E-02	316-5	6E-03
100-F-23	1E-02	100-D-49:2	1E-02	600-131	1E-02	100-F-18	6E-03
118-C-2	1E-02	100-D-48:2	1E-02	122-DR-1:2	1E-02	300-45	6E-03
100-F-16	1E-02	116-B-3	1E-02	116-KW-4	1E-02	600-233	6E-03
116-B-6B	1E-02	116-KW-3	1E-02	100-F-2	1E-02	120-N-1	5E-03
100-D-21	1E-02	116-K-2	1E-02	100-B-14:6	1E-02		

Table 5-48a. Industrial / Commercial RME Hazard Index: Ratio of Background and Total HI Values.

Waste Site ID	RME HI ratio	Waste Site ID	RME HI ratio	Waste Site ID	RME HI ratio	Waste Site ID	RME HI ratio
100-K-33	3.E-01	1607-D2:1	1	100-D-48:2	1	100-F-26:5	1
600-23	4.E-01	116-D-4	1	100-D-49:2	1	600-131	1
618-4	4.E-01	100-H-5	1	116-KW-3	1	100-F-2	1
128-C-1	5.E-01	100-H-24	1	116-K-2	1	116-B-15	1
300-10	6.E-01	100-C-3	1	116-C-5	1	116-N-3	1
1607-B8	7.E-01	300-49	1	100-K-56:1	1	116-C-6	1
600-181	8.E-01	100-F-24	1	100-K-55:1	1	100-K-31	1
118-C-4	9.E-01	118-B-4	1	116-C-1	1	100-B-14:6	1
316-1	9.E-01	100-H-17	1	116-DR-1&2	1	100-F-35	1
628-4	1.E+00	1607-D2:4	1	116-F-3	1	116-F-4	1
600-190	1.E+00	100-F-25	1	116-K-1	1	100-K-29	1
600-204	1.E+00	116-DR-9	1	100-D-48:1	1	1607-D4	1
100-K-30	1.E+00	116-B-10	1	116-F-2	1	300-8	1
316-2	1.E+00	116-F-1	1	116-F-11	1	300-18	1
300 ASH PITS	1.E+00	100-D-21	1	100-B-5	1	628-1	1
100-K-32	1	UPR-100-F-2	1	116-F-6	1	128-K-1	1
116-H-7	1	118-DR-2:2	1	116-B-4	1	100-F-26:7	1
100-D-4	1	116-B-9	1	116-B-14	1	300 VTS	1
1607-F6	1	100-F-38	1	116-B-1	1	600-235	1
100-F-37	1	116-B-13	1	100-F-15	1	100-B-16	1
118-F-8:1	1	116-KE-4	1	100-F-11	1	100-B-14:3	1
100-D-22	1	118-B-9	1	100-F-4	1	100-C-9:3	1
300-50	1	116-F-10	1	116-F-9	1	600-107	1
1607-H2	1	100-D-12	1	116-B-12	1	100-F-26:1	1
1607-H4	1	116-B-3	1	100-F-19:1	1	100-B-11	1
100-H-21	1	118-B-3	1	116-F-7	1	128-F-1	1
1607-B11	1	100-D-20	1	1607-F2	1	600-232	1
1607-B10	1	116-B-7	1	100-B-8:2	1	600-132	1
100-B-14:7	1	116-C-2A	1	116-B-2	1	100-F-12	1
100-F-23	1	116-B-11	1	1607-D2:3	1	100-B-14:5	1
118-C-2	1	116-B-6A	1	116-D-7	1	100-F-9	1
1607-B9	1	100-F-19:2	1	600-259	1	100-F-7	1
100-F-16	1	100-B-8:1	1	100-D-52	1	100-F-14	1
116-B-6B	1	100-D-48:4	1	600-128	1	120-N-1	1
118-B-10	1	100-D-48:3	1	618-5	1	100-F-26:2	1
1607-B7	1	116-D-1A	1	116-KE-5	1	300-45	1
116-H-1	1	116-D-2	1	122-DR-1:2	1	600-233	1
JA JONES	1	116-DR-7	1	116-F-14	1	116-F-5	1
618-12	1	116-D-9	1	116-KW-4	1	316-5	1
128-B-2	1	116-DR-4	1	118-B-5	1	100-F-18	1
100-D-49:4	1	116-DR-6	1	600-47	1		

Table 5-48b. Industrial / Commercial CTE Hazard Index: Ratio of Background and Total HI Values.

Waste Site ID	CTE HI ratio	Waste Site ID	CTE HI ratio	Waste Site ID	CTE HI ratio	Waste Site ID	CTE HI ratio
600-181	2.E-01	100-H-5	9.E-01	116-B-6A	9.E-01	116-N-3	1.E+00
118-C-4	3.E-01	JA JONES	9.E-01	100-K-56:1	9.E-01	116-F-14	1.E+00
600-23	3.E-01	116-F-1	9.E-01	100-K-55:1	9.E-01	118-B-5	1.E+00
600-204	4.E-01	116-H-1	9.E-01	116-B-7	9.E-01	600-47	1.E+00
128-C-1	4.E-01	116-D-4	9.E-01	116-DR-1&2	9.E-01	100-F-26:5	1.E+00
316-1	5.E-01	100-K-31	9.E-01	116-K-1	9.E-01	118-B-9	1.E+00
100-F-37	5.E-01	100-D-20	9.E-01	100-D-48:1	9.E-01	128-K-1	1.E+00
618-4	5.E-01	118-DR-2:2	9.E-01	116-F-11	9.E-01	100-F-35	1.E+00
316-2	5.E-01	118-B-10	9.E-01	116-F-3	9.E-01	300 VTS	1.E+00
600-190	5.E-01	118-B-4	9.E-01	116-B-4	9.E-01	300-8	1.E+00
100-K-30	6.E-01	100-F-24	9.E-01	116-F-6	9.E-01	116-C-6	1.E+00
600-128	7.E-01	100-F-25	9.E-01	116-F-2	9.E-01	628-1	1.E+00
118-F-8:1	7.E-01	116-B-10	9.E-01	116-B-14	9.E-01	600-235	1.E+00
100-H-21	8.E-01	UPR-100-F-2	9.E-01	100-F-11	9.E-01	100-B-16	1.E+00
116-H-7	8.E-01	128-B-2	9.E-01	100-B-5	9.E-01	100-C-9:3	1.E+00
300 ASH PITS	8.E-01	116-B-9	9.E-01	100-F-15	9.E-01	100-B-14:3	1.E+00
1607-B8	8.E-01	100-K-32	9.E-01	116-C-1	9.E-01	100-F-12	1.E+00
100-D-22	8.E-01	100-H-17	9.E-01	100-F-4	9.E-01	600-107	1.E+00
1607-H2	8.E-01	100-C-3	9.E-01	116-B-12	9.E-01	100-F-38	1.E+00
1607-F6	8.E-01	116-B-13	9.E-01	116-F-9	9.E-01	128-F-1	1.E+00
1607-H4	8.E-01	116-KE-4	9.E-01	116-F-7	9.E-01	600-132	1.E+00
300-10	8.E-01	300-49	9.E-01	116-C-5	9.E-01	100-B-11	1.E+00
116-B-15	8.E-01	100-D-12	9.E-01	100-B-8:2	9.E-01	300-18	1.E+00
100-B-14:7	8.E-01	116-F-10	9.E-01	116-KE-5	9.E-01	100-F-9	1.E+00
100-D-4	9.E-01	1607-D2:1	9.E-01	116-B-1	9.E-01	100-K-29	1.E+00
100-K-33	9.E-01	116-B-11	9.E-01	1607-F2	9.E-01	100-F-26:7	1.E+00
1607-B11	9.E-01	116-C-2A	9.E-01	100-F-19:1	9.E-01	600-232	1.E+00
1607-B10	9.E-01	116-D-1A	9.E-01	116-B-2	9.E-01	100-F-26:1	1.E+00
300-50	9.E-01	100-D-48:3	9.E-01	1607-D2:3	9.E-01	100-F-7	1.E+00
100-H-24	9.E-01	116-D-2	9.E-01	116-D-7	9.E-01	100-B-14:5	1.E+00
618-12	9.E-01	116-DR-7	9.E-01	600-259	9.E-01	116-F-4	1.E+00
1607-B9	9.E-01	100-B-8:1	9.E-01	100-D-52	9.E-01	100-F-26:2	1.E+00
100-D-49:4	9.E-01	116-D-9	9.E-01	100-F-19:2	9.E-01	116-F-5	1.E+00
1607-B7	9.E-01	116-DR-4	9.E-01	618-5	9.E-01	100-F-14	1.E+00
1607-D2:4	9.E-01	116-DR-6	9.E-01	118-B-3	9.E-01	1607-D4	1
116-DR-9	9.E-01	100-D-48:4	9.E-01	628-4	9.E-01	316-5	1
100-F-23	9.E-01	100-D-48:2	9.E-01	600-131	1.E+00	100-F-18	1
118-C-2	9.E-01	100-D-49:2	9.E-01	122-DR-1:2	1.E+00	300-45	1
100-F-16	9.E-01	116-B-3	9.E-01	116-KW-4	1.E+00	600-233	1
116-B-6B	9.E-01	116-KW-3	9.E-01	100-F-2	1.E+00	120-N-1	1
100-D-21	9.E-01	116-K-2	9.E-01	100-B-14:6	1.E+00		

Table 5-49a. Casual User and Avid Hunter Total Cancer Risk Results.

Scenario	RME	CTE
Hunter	1E-04	4E-06
Hunter (w/o game)	3E-06	2E-07
Casual User	3E-06	1E-07

Table 5-49b. Casual User and Avid Hunter Background Cancer Risk Results.

Scenario	RME	CTE
Hunter	3E-05	2E-06
Hunter (w/o game)	2E-06	2E-07
Casual User	3E-06	1E-07

Table 5-50. Avid Angler Cancer Risk Results for Sediment Exposures.

Scenario	RME	CTE
100 Area	7E-06	3E-07
300 Area	1E-05	4E-07
B/C Pilot	2E-06	1E-07
100-NR-2	3E-05	1E-06
Reference Area	4E-06	2E-07

Table 5-51a. Casual User and Avid Hunter Total Radiation Dose Results.

Scenario	RME (mrem/year)	CTE (mrem/year)
Hunter	3E-01	5E-02
Hunter (w/o game)	1E-01	3E-02
Casual User	1E-01	1E-02

Table 5-51b. Casual User and Avid Hunter Background Radiation Dose Results.

Scenario	RME (mrem/year)	CTE (mrem/year)
Hunter	1.7E-01	4.2E-02
Hunter (w/o game)	8.0E-02	2.4E-02
Casual User	9.0E-02	1.3E-02

Table 5-52. Avid Angler Radiation Dose Results for Sediment Exposures.

Scenario	RME (mrem/year)	CTE (mrem/year)
100 Area	2E-01	3E-02
300 Area	5E-01	4E-02
B/C Pilot	4E-02	5E-03
100-NR-2	1E+00	2E-01
Reference Area	2E-01	2E-02

Table 5-53a. Casual User and Avid Hunter Total Child Hazard Index Results.

Scenario	RME	CTE
Hunter	3.2E+00	4.5E-01
Hunter (w/o game)	2.8E-02	2.7E-03
Casual User	2.9E-02	2.1E-03

Table 5-53b. Casual User and Avid Hunter Background Child Hazard Index Results.

Scenario	RME	CTE
Hunter	3.8E+00	2.9E-01
Hunter (w/o game)	4.7E-02	2.3E-03
Casual User	3.0E-02	2.5E-03

Table 5-54. Avid Angler Radiation Child Hazard Index Results for Sediment Exposures.

Exposure Area	RME	CTE
100 Area	8E-02	5E-03
300 Area	5E-02	5E-03
B/C Pilot	8E-02	1E-02
100-NR-2	2E-02	2E-03
Reference Area	4E-02	4E-03

Table 5-55. Avid Angler Fish Ingestion Cancer Risks.

Exposure Area	RME	CTE
100 Area (a)	>1E-02	7E-03
300 Area (a)	>1E-02	1E-02
B/C Pilot (a)	>1E-02	9E-04
100-NR-2 (b)	1E-05	2E-07
Reference Area	3E-03	1E-04

(a) Calculated risks related to elevated detection limits for organic chemicals.
(b) Analytical data in fish tissue limited to strontium-90 and technetium-99.

Table 5-56. Rural Resident Fish Ingestion Cancer Risks.

Exposure Area	RME	CTE
100 Area (a)	>1E-02	7E-03
300 Area (a)	>1E-02	1E-02
B/C Pilot (a)	9E-03	9E-04
100-NR-2 (b)	3E-06	2E-07
Reference Area	9E-04	1E-04

(a) Calculated risks related to elevated detection limits for organic chemicals.
(b) Analytical data in fish tissue limited to strontium-90 and technetium-99.

Table 5-57. CTUIR Fish Ingestion Cancer Risks.

Exposure Area	
100 Area (a)	>1E-02
300 Area (a)	>1E-02
B/C Pilot (a)	>1E-02
100-NR-2 (b)	7E-05
Reference Area	>1E-02

(a) Calculated risks related to elevated detection limits for organic chemicals.
(b) Analytical data in fish tissue limited to strontium-90 and technetium-99.

Table 5-58. Avid Angler Fish Ingestion Radiation Dose.

Exposure Area	RME (mrem/year)	CTE (mrem/year)
100 Area (a)	5E+01	6E+00
300 Area (a)	5E+01	5E+00
B/C Pilot (b)	9E-01	1E-01
100-NR-2 (b)	5E-01	2E-02
Reference Area (a)	9E+01	5E+00

(a) Calculated doses related primarily to americium-241.
(b) Analytical data in fish tissue limited to strontium-90 and technetium-99.

Table 5-59. Rural Resident Fish Ingestion Radiation Dose.

Exposure Area	RME (mrem/year)	CTE (mrem/year)
100 Area (a)	1E+01	6E+00
300 Area (a)	1E+01	5E+00
B/C Pilot (b)	2E-01	1E-01
100-NR-2 (b)	1E-01	2E-02
Reference Area (a)	2E+01	5E+00

(a) Calculated doses related primarily to americium-241.
(b) Analytical data in fish tissue limited to strontium-90 and technetium-99.

Table 5-60. CTUIR Fish Ingestion Radiation Dose.

Exposure Area	(mrem/year)
100 Area (a)	1E+02
300 Area (a)	1E+02
B/C Pilot (b)	3E+00
100-NR-2 (b)	1E+00
Reference Area (a)	2E+02

(a) Calculated doses related primarily to americium-241.
(b) Analytical data in fish tissue limited to strontium-90 and technetium-99.

Table 5-61. Avid Angler Fish Ingestion Hazard Indices.

Exposure Area	RME	CTE
100 Area (a)	1E+03	9E+01
300 Area (a)	4E+03	6E+01
B/C Pilot (a)	2E+03	2E+02
Reference Area	2E+02	2E+01

(a) Calculated risks related to elevated detection limits for organic chemicals.

Table 5-62. Rural Resident Fish Ingestion Hazard Indices.

Exposure Area	RME	CTE
100 Area (a)	3E+02	9E+01
300 Area (a)	1E+03	6E+01
B/C Pilot (a)	5E+02	2E+02
Reference Area	6E+01	2E+01

(a) Calculated risks related to elevated detection limits for organic chemicals.

Table 5-63. CTUIR Fish Ingestion Hazard Indices.

Exposure Area	
100 Area [a]	3E+03
300 Area [a]	1E+04
B/C Pilot [a]	6E+03
Reference Area	6E+02

[a] Calculated risks related to elevated detection limits for organic chemicals.

Table 5-64. Cancer Risks Related to Potassium-40, Isotopic Thorium, and Isotopic Radium.

Exposure Scenario	RME	CTE
Rural Resident	2E-03	3E-04
Rural Resident (fish ingestion)	1E-03	7E-06
Resident Monument Worker	3E-04	6E-05
Industrial / Commercial	1E-04	3E-05
Avid Hunter	4E-04	3E-05
Avid Hunter (w/o game)	2E-05	2E-06
Avid Angler (sediment exposures)	4E-05	2E-06
Avid Angler (fish ingestion)	5E-03	7E-06
Casual User	2E-05	7E-07
CTUIR (local area only)	6E-03	
CTUIR (local and broad areas)	3E-03	
CTUIR (fish ingestion pathway)	>1E-02	

Table 5-65. Radiation Doses Related to Potassium-40, Isotopic Thorium, and Isotopic Radium.

Exposure Scenario	RME (mrem/year)	CTE (mrem/year)
Rural Resident	5E+01	3E+01
Rural Resident (fish ingestion)	3E+01	2E+00
Resident Monument Worker	1E+01	1E+01
Industrial / Commercial	6E+00	6E+00
Avid Hunter	8E+00	2E+00
Avid Hunter (w/o game)	7E-01	2E-01
Avid Angler (sediment exposures)	2E+00	3E-01
Avid Angler (fish ingestion)	1E+02	2E+00
Casual User	2E-05	7E-07
CTUIR (local area only)	8E+01	
CTUIR (local and broad areas)	4E+01	
CTUIR (fish ingestion pathway)	3E+02	

Table 5-66. CTUIR Groundwater Total Cancer Risk Results.

Operational Area	Well ID	Cancer Risk	Operational Area	Well ID	Cancer Risk
100-D	B8778	>1.E-02	300 AREA	A5018	3.E-03
100-D	B8753	>1.E-02	300 AREA	A5049	2.E-03
100-D	A4570	>1.E-02	300 AREA	A8089	2.E-03
100-D	B8750	>1.E-02	300 AREA	A5035	2.E-03
100-D	A4573	8.E-03	300 AREA	A5024	2.E-03
100-D	A4568	3.E-03	300 AREA	A5052	2.E-03
100-D	A4574	3.E-03	300 AREA	A5020	2.E-03
100-D	B8779	2.E-03	300 AREA	A5056	0.E+00
100-D	B8744	1.E-04	NA[1]	199-N-80	>1.E-02
100-F	A4600	1.E-02	NA	A4647	>1.E-02
100-F	A4608	2.E-03	NA	199-K-22	1.E-02
100-H	A4614	>1.E-02	NA	A9910	1.E-02
100-H	A4632	8.E-03	NA	A4649	4.E-03
100-H	A4613	5.E-03	NA	A4650	3.E-03
100-H	A4630	3.E-03	NA	A9882	3.E-03
100-H	A4642	3.E-03	NA	199-F7-3	2.E-03
100-H	A4636	2.E-03	NA	199-F7-1	2.E-03
100-H	A4619	2.E-03	NA	A4587	1.E-03
100-H	A4626	1.E-03	NA	199-F7-2	1.E-03
100-H	A4641	6.E-04	NA	A4677	1.E-03
100-K	C4670	>1.E-02	NA	199-N-70	1.E-03
100-K	399-4-9	5.E-03	NA	A4657	1.E-03
100-K	A4653	3.E-03	NA	B8074	1.E-03
100-K	A4660	2.E-03	NA	A4681	5.E-04
100-K	A4662	2.E-03	NA	199-F5-47	5.E-04
100-N	A4679	8.E-03	NA	199-F5-45	5.E-04
100-N	A4708	8.E-03	NA	199-F5-48	4.E-04
100-N	A4675	3.E-03	NA	A4717	2.E-04
100-N	A4716	1.E-03	NA	199-F5-43B	2.E-04
100-N	A4665	1.E-03	NA	199-F5-42	1.E-04
300 AREA	A5044	6.E-03	NA	199-H4-48	1.E-04
300 AREA	A8077	3.E-03	NA	A9878	1.E-04

[1] Not available; the operational area was not recorded for these wells.

Table 5-67. CTUIR Groundwater ILCR Results.

Operational Area	Well ID	ILCR	Operational Area	Well ID	ILCR
100-D	B8778	>1.E-02	300 AREA	A5018	2.E-03
100-D	B8753	>1.E-02	300 AREA	A5049	2.E-03
100-D	A4570	>1.E-02	300 AREA	A8089	2.E-03
100-D	B8750	>1.E-02	300 AREA	A5035	2.E-03
100-D	A4573	8.E-03	300 AREA	A5024	2.E-03
100-D	A4568	3.E-03	300 AREA	A5052	2.E-03
100-D	A4574	3.E-03	300 AREA	A5020	1.E-03
100-D	B8779	2.E-03	300 AREA	A5056	0.E+00
100-D	B8744	9.E-06	NA[1]	199-N-80	>1.E-02
100-F	A4600	1.E-02	NA	A4647	>1.E-02
100-F	A4608	2.E-03	NA	199-K-22	1.E-02
100-H	A4614	1.E-02	NA	A9910	1.E-02
100-H	A4632	8.E-03	NA	A4649	4.E-03
100-H	A4613	4.E-03	NA	A4650	3.E-03
100-H	A4630	3.E-03	NA	A9882	3.E-03
100-H	A4642	3.E-03	NA	A4587	1.E-03
100-H	A4636	2.E-03	NA	199-F7-3	1.E-03
100-H	A4619	2.E-03	NA	199-F7-1	1.E-03
100-H	A4626	1.E-03	NA	A4677	1.E-03
100-H	A4641	4.E-04	NA	199-F7-2	1.E-03
100-K	C4670	>1.E-02	NA	199-N-70	8.E-04
100-K	399-4-9	4.E-03	NA	A4657	8.E-04
100-K	A4653	2.E-03	NA	B8074	7.E-04
100-K	A4660	2.E-03	NA	A4681	4.E-04
100-K	A4662	1.E-03	NA	199-F5-47	4.E-04
100-N	A4679	8.E-03	NA	199-F5-45	3.E-04
100-N	A4708	7.E-03	NA	199-F5-48	3.E-04
100-N	A4675	2.E-03	NA	A4717	1.E-04
100-N	A4665	1.E-03	NA	199-F5-43B	1.E-04
100-N	A4716	1.E-03	NA	A9878	1.E-04
300 AREA	A5044	6.E-03	NA	199-H4-48	3.E-05
300 AREA	A8077	3.E-03	NA	199-F5-42	2.E-05

[1] Not available; the operational area was not recorded for these wells.

Table 5-68. CTUIR Groundwater Total Radiation Dose Results.

Operational Area	Well ID	Dose (mrem/yr)	Operational Area	Well ID	Dose (mrem/yr)
100-DDR	A4573	40	300 AREA	A5018	291
100-DDR	B8778	32	300 AREA	A8089	131
100-DDR	A4574	25	300 AREA	A5052	118
100-DDR	A4570	24	300 AREA	A5049	105
100-DDR	B8750	20	300 AREA	A5020	59
100-DDR	B8779	19	300 AREA	A5035	53
100-DDR	B8753	14	300 AREA	A5024	46
100-DDR	A4568	12	300 AREA	A5056	0
100-DDR	B8744	8.4	NA[1]	A9910	397
100-F	A4600	74	NA	199-F7-3	70
100-F	A4608	50	NA	199-F7-2	67
100-H	A4630	75	NA	199-F5-45	67
100-H	A4636	39	NA	199-F5-47	62
100-H	A4619	38	NA	199-F5-48	47
100-H	A4642	31	NA	199-F7-1	46
100-H	A4632	28	NA	199-N-80	43
100-H	A4626	19	NA	A4650	39
100-H	A4614	10	NA	A4587	32
100-H	A4641	3.5	NA	199-K-22	25
100-H	A4613	1.2	NA	A4677	23
100-K	399-4-9	569	NA	A4681	21
100-K	C4670	52	NA	A4717	21
100-K	A4660	42	NA	A9882	19
100-K	A4662	35	NA	199-F5-43B	18
100-K	A4653	29	NA	B8074	18
100-N	A4679	340	NA	199-N-70	17
100-N	A4708	13	NA	A4657	16
100-N	A4675	10	NA	A4649	15
100-N	A4665	8.0	NA	199-F5-42	14
100-N	A4716	4.8	NA	199-H4-48	12
300 AREA	A5044	840	NA	A4647	5.8
300 AREA	A8077	345	NA	A9878	0.68

[1] Not available; the operational area was not recorded for these wells.

Table 5-69. CTUIR Groundwater Incremental Radiation Dose Results.

Operational Area	Well ID	Dose (mrem/yr)	Operational Area	Well ID	Dose (mrem/yr)
100-DDR	A4573	26	300 AREA	A8077	330
100-DDR	B8778	17	300 AREA	A5018	277
100-DDR	A4574	10	300 AREA	A8089	116
100-DDR	A4570	9	300 AREA	A5052	103
100-DDR	B8750	5.4	300 AREA	A5049	90
100-DDR	B8779	5.0	300 AREA	A5020	45
100-DDR	B8753	0	300 AREA	A5035	38
100-DDR	A4568	0	300 AREA	A5024	32
100-DDR	B8744	0	NA[1]	A9910	397
100-F	A4600	59	NA	199-F7-3	55
100-F	A4608	36	NA	199-F7-2	53
100-H	A4630	60	NA	199-F5-45	52
100-H	A4636	24	NA	199-F5-47	47
100-H	A4619	23	NA	199-F5-48	32
100-H	A4642	17	NA	199-F7-1	32
100-H	A4632	13	NA	199-N-80	28
100-H	A4626	4.6	NA	A4650	24
100-H	A4613	1.1	NA	A4587	18
100-H	A4641	0	NA	199-K-22	10
100-H	A4614	0	NA	A4677	8.9
100-K	399-4-9	554	NA	A4681	6.2
100-K	C4670	37	NA	A4717	6.1
100-K	A4660	28	NA	A9882	4.6
100-K	A4662	21	NA	199-F5-43B	3.7
100-K	A4653	14	NA	B8074	3.0
100-N	A4679	326	NA	199-N-70	2.6
100-N	A4708	0	NA	A4657	1.1
100-N	A4675	0	NA	A9878	0.68
100-N	A4665	0	NA	A4649	0.095
100-N	A4716	0	NA	199-F5-42	0
300 AREA	A5056	0	NA	A4647	0
300 AREA	A5044	825	NA	199-H4-48	0

[1] Not available; the operational area was not recorded for these wells.

Table 5-70. CTUIR Groundwater Adult Chemical Hazard Index Results.

Operational Area	Well ID	Hazard Index	Operational Area	Well ID	Hazard Index
100-DDR	B8778	139	300 AREA	A5049	5.7
100-DDR	B8753	134	300 AREA	A5035	5.6
100-DDR	A4570	67	300 AREA	A5044	5.2
100-DDR	B8750	29	300 AREA	A5024	4.9
100-DDR	B8779	12	300 AREA	A5018	4.6
100-DDR	A4573	10	300 AREA	A8089	4.3
100-DDR	B8744	6.9	300 AREA	A5052	3.1
100-DDR	A4568	6.5	300 AREA	A5056	0.0
100-DDR	A4574	6.0	NA[2]	A4650	28
100-F	A4600	14	NA	A9882	26
100-F	A4608	5.1	NA	A4647	25
100-H	A4614	311 (557)[1]	NA	199-N-80	25
100-H	A4632	10	NA	199-F5-43B	22
100-H	A4613	6.8	NA	A4649	21
100-H	A4630	5.5	NA	199-K-22	16
100-H	A4642	5.2	NA	A4681	8.2
100-H	A4636	4.4	NA	199-F5-42	7.8
100-H	A4619	3.4	NA	A4587	7.5
100-H	A4626	2.8	NA	199-F7-1	5.2
100-H	A4641	2.5	NA	199-F7-3	5.1
100-K	C4670	18	NA	199-F7-2	4.2
100-K	A4653	15	NA	B8074	3.9
100-K	399-4-9	6.2	NA	199-F5-45	3.0
100-K	A4662	5.7	NA	A4677	2.7
100-K	A4660	2.0	NA	199-F5-47	2.7
100-N	A4675	338	NA	199-N-70	2.7
100-N	A4665	266	NA	A4657	2.4
100-N	A4708	10	NA	199-F5-48	2.1
100-N	A4716	8.5	NA	A4717	1.6
100-N	A4679	4.3	NA	199-H4-48	1.4
300 AREA	A5020	9.2	NA	A9878	1.0
300 AREA	A8077	9.1	NA	A9910	0.8

[1] Value in parentheses is the child HI.
[2] Not available; the operational area was not recorded for these wells.

Table 5-71. CTUIR Groundwater Adult Chemical Hazard Index: Ratio of Background and Total HI Values.

Operational Area	Well ID	Background HI / total HI	Operational Area	Well ID	Background HI / total HI
100-DDR	A4568	0.26	300 AREA	A5024	0.35
100-DDR	A4570	0.03	300 AREA	A5035	0.39
100-DDR	A4573	0.12	300 AREA	A5044	0.37
100-DDR	A4574	0.28	300 AREA	A5049	0.30
100-DDR	B8744	0.31	300 AREA	A5052	0.54
100-DDR	B8750	0.06	300 AREA	A5056	na[2]
100-DDR	B8753	0.01	300 AREA	A8077	0.23
100-DDR	B8778	0.01	300 AREA	A8089	0.30
100-DDR	B8779	0.12	NA[1]	199-F5-42	0.22
100-F	A4600	0.10	NA	199-F5-43B	0.08
100-F	A4608	0.26	NA	199-F5-45	0.43
100-H	A4613	0.25	NA	199-F5-47	0.65
100-H	A4614	0.01	NA	199-F5-48	0.81
100-H	A4619	0.40	NA	199-F7-1	0.49
100-H	A4626	0.62	NA	199-F7-2	0.42
100-H	A4630	0.85	NA	199-F7-3	0.42
100-H	A4632	0.17	NA	199-H4-48	0.99
100-H	A4636	0.31	NA	199-K-22	0.09
100-H	A4641	0.68	NA	199-N-70	0.66
100-H	A4642	0.34	NA	199-N-80	0.09
100-K	399-4-9	0.36	NA	A4587	0.18
100-K	A4653	0.11	NA	A4647	0.07
100-K	A4660	0.84	NA	A4649	0.07
100-K	A4662	0.38	NA	A4650	0.06
100-K	C4670	0.09	NA	A4657	0.72
100-N	A4665	0.01	NA	A4677	0.50
100-N	A4675	0.02	NA	A4681	0.17
100-N	A4679	0.32	NA	A4717	0.84
100-N	A4708	0.17	NA	A9878	0.91
100-N	A4716	0.35	NA	A9882	0.04
300 AREA	A5018	0.49	NA	A9910	1.00
300 AREA	A5020	0.28	NA	B8074	0.43

[1] Not available; the operational area was not recorded for these wells.
[2] One or both HI values is zero.

Table 5-72. Rural Residential Groundwater Total Cancer Risk Results.

Operational Area	Well ID	RME cancer risk	CTE cancer risk	Operational Area	Well ID	RME cancer risk	CTE cancer risk
100-D	A4568	1.E-04	2.E-05	300 AREA	A5024	4.E-04	8.E-05
100-D	A4570	4.E-05	9.E-06	300 AREA	A5035	5.E-04	9.E-05
100-D	A4573	5.E-05	7.E-06	300 AREA	A5044	2.E-04	3.E-05
100-D	A4574	7.E-05	1.E-05	300 AREA	A5049	2.E-04	3.E-05
100-D	B8744	2.E-05	5.E-06	300 AREA	A5052	2.E-04	3.E-05
100-D	B8750	5.E-06	5.E-07	300 AREA	A5056	0.E+00	0.E+00
100-D	B8753	1.E-04	2.E-05	300 AREA	A8077	3.E-04	6.E-05
100-D	B8778	3.E-05	7.E-06	300 AREA	A8089	3.E-04	5.E-05
100-D	B8779	1.E-05	3.E-06	NA[1]	199-F5-42	2.E-05	3.E-06
100-F	A4600	4.E-05	5.E-06	NA	199-F5-43B	2.E-05	4.E-06
100-F	A4608	1.E-04	2.E-05	NA	199-F5-45	2.E-05	3.E-06
100-H	A4613	2.E-04	4.E-05	NA	199-F5-47	3.E-05	4.E-06
100-H	A4614	6.E-03	1.E-03	NA	199-F5-48	5.E-05	9.E-06
100-H	A4619	1.E-04	2.E-05	NA	199-F7-1	2.E-04	3.E-05
100-H	A4626	1.E-04	2.E-05	NA	199-F7-2	2.E-04	3.E-05
100-H	A4630	2.E-04	2.E-05	NA	199-F7-3	2.E-04	4.E-05
100-H	A4632	2.E-04	3.E-05	NA	199-H4-48	2.E-05	4.E-06
100-H	A4636	1.E-05	1.E-06	NA	199-K-22	1.E-04	2.E-05
100-H	A4641	1.E-04	2.E-05	NA	199-N-70	2.E-04	3.E-05
100-H	A4642	2.E-04	3.E-05	NA	199-N-80	2.E-04	3.E-05
100-K	399-4-9	3.E-04	5.E-05	NA	A4587	3.E-04	5.E-05
100-K	A4653	7.E-04	1.E-04	NA	A4647	4.E-04	6.E-05
100-K	A4660	3.E-04	4.E-05	NA	A4649	1.E-04	3.E-05
100-K	A4662	3.E-04	4.E-05	NA	A4650	2.E-04	2.E-05
100-K	C4670	4.E-04	5.E-05	NA	A4657	2.E-04	3.E-05
100-N	A4665	3.E-04	7.E-05	NA	A4677	3.E-04	6.E-05
100-N	A4675	3.E-04	5.E-05	NA	A4681	8.E-05	9.E-06
100-N	A4679	2.E-03	1.E-04	NA	A4717	3.E-05	6.E-06
100-N	A4708	3.E-05	3.E-06	NA	A9878	3.E-05	5.E-06
100-N	A4716	3.E-04	4.E-05	NA	A9882	2.E-05	4.E-06
300 AREA	A5018	2.E-04	3.E-05	NA	A9910	2.E-03	2.E-04
300 AREA	A5020	2.E-04	3.E-05	NA	B8074	2.E-04	3.E-05

[1] Not available; the operational area was not recorded for these wells.

Table 5-73. Rural Residential Groundwater ILCR Results.

Operational Area	Well ID	RME ILCR	CTE ILCR	Operational Area	Well ID	RME ILCR	CTE ILCR
100-D	A4568	8.E-05	1.E-05	300 AREA	A5024	4.E-04	8.E-05
100-D	A4570	4.E-05	9.E-06	300 AREA	A5035	4.E-04	8.E-05
100-D	A4573	5.E-05	7.E-06	300 AREA	A5044	2.E-04	3.E-05
100-D	A4574	7.E-05	9.E-06	300 AREA	A5049	2.E-04	3.E-05
100-D	B8744	2.E-05	5.E-06	300 AREA	A5052	1.E-04	2.E-05
100-D	B8750	2.E-06	2.E-07	300 AREA	A5056	0.E+00	0.E+00
100-D	B8753	5.E-05	9.E-06	300 AREA	A8077	3.E-04	6.E-05
100-D	B8778	3.E-05	7.E-06	300 AREA	A8089	3.E-04	4.E-05
100-D	B8779	1.E-05	2.E-06	NA[1]	199-F5-42	1.E-05	3.E-06
100-F	A4600	4.E-05	5.E-06	NA	199-F5-43B	2.E-05	4.E-06
100-F	A4608	1.E-04	2.E-05	NA	199-F5-45	2.E-05	3.E-06
100-H	A4613	1.E-04	3.E-05	NA	199-F5-47	3.E-05	4.E-06
100-H	A4614	6.E-03	1.E-03	NA	199-F5-48	5.E-05	9.E-06
100-H	A4619	1.E-04	2.E-05	NA	199-F7-1	2.E-04	3.E-05
100-H	A4626	1.E-04	1.E-05	NA	199-F7-2	1.E-04	2.E-05
100-H	A4630	1.E-04	2.E-05	NA	199-F7-3	2.E-04	3.E-05
100-H	A4632	1.E-04	2.E-05	NA	199-H4-48	2.E-05	4.E-06
100-H	A4636	1.E-05	1.E-06	NA	199-K-22	1.E-04	2.E-05
100-H	A4641	7.E-05	1.E-05	NA	199-N-70	1.E-04	2.E-05
100-H	A4642	2.E-04	3.E-05	NA	199-N-80	2.E-04	2.E-05
100-K	399-4-9	3.E-04	4.E-05	NA	A4587	3.E-04	5.E-05
100-K	A4653	7.E-04	1.E-04	NA	A4647	3.E-04	6.E-05
100-K	A4660	3.E-04	4.E-05	NA	A4649	1.E-04	3.E-05
100-K	A4662	2.E-04	4.E-05	NA	A4650	2.E-04	2.E-05
100-K	C4670	3.E-04	4.E-05	NA	A4657	2.E-04	2.E-05
100-N	A4665	3.E-04	7.E-05	NA	A4677	3.E-04	6.E-05
100-N	A4675	3.E-04	4.E-05	NA	A4681	7.E-05	9.E-06
100-N	A4679	2.E-03	1.E-04	NA	A4717	3.E-05	5.E-06
100-N	A4708	3.E-05	3.E-06	NA	A9878	3.E-05	5.E-06
100-N	A4716	2.E-04	3.E-05	NA	A9882	2.E-05	4.E-06
300 AREA	A5018	2.E-04	3.E-05	NA	A9910	2.E-03	2.E-04
300 AREA	A5020	2.E-04	3.E-05	NA	B8074	1.E-04	2.E-05

[1] Not available; the operational area was not recorded for these wells.

Table 5-74. Rural Residential Groundwater Total Radiation Dose Results.

Operational Area	Well ID	RME Dose	CTE Dose	Operational Area	Well ID	RME Dose	CTE Dose
100-DDR	A4568	0.35	0.21	300 AREA	A5024	1.5	0.94
100-DDR	A4570	0.64	0.39	300 AREA	A5035	1.5	0.88
100-DDR	A4573	1.5	0.92	300 AREA	A5044	19	12
100-DDR	A4574	1.5	0.91	300 AREA	A5049	2.4	1.4
100-DDR	B8744	0.19	0.12	300 AREA	A5052	2.6	1.6
100-DDR	B8750	0.48	0.29	300 AREA	A5056	0.0	0
100-DDR	B8753	0.34	0.21	300 AREA	A8077	8.1	5.0
100-DDR	B8778	0.73	0.44	300 AREA	A8089	3.0	1.8
100-DDR	B8779	0.46	0.28	NA[1]	199-F5-42	0.63	0.38
100-F	A4600	2.6	1.6	NA	199-F5-43B	0.41	0.25
100-F	A4608	1.8	1.1	NA	199-F5-45	1.6	0.95
100-H	A4613	0.46	0.28	NA	199-F5-47	1.7	1.0
100-H	A4614	0.31	0.19	NA	199-F5-48	1.2	0.75
100-H	A4619	5.2	3.2	NA	199-F7-1	1.0	0.64
100-H	A4626	1.5	0.91	NA	199-F7-2	1.5	0.90
100-H	A4630	2.4	1.48	NA	199-F7-3	1.6	0.95
100-H	A4632	1.0	0.63	NA	199-H4-48	0.30	0.14
100-H	A4636	1.0	0.62	NA	199-K-22	5.6	3.4
100-H	A4641	0.26	0.16	NA	199-N-70	1.1	0.70
100-H	A4642	1.8	1.1	NA	199-N-80	1.9	1.2
100-K	399-4-9	13	7.9	NA	A4587	6.2	3.8
100-K	A4653	2.3	1.4	NA	A4647	2.0	1.2
100-K	A4660	10	6.2	NA	A4649	1.3	0.76
100-K	A4662	1.0	0.63	NA	A4650	11	6.5
100-K	C4670	10	6.2	NA	A4657	1.6	0.95
100-N	A4665	0.18	0.11	NA	A4677	5.5	3.4
100-N	A4675	0.22	0.13	NA	A4681	1.7	0.98
100-N	A4679	117	71	NA	A4717	0.76	0.46
100-N	A4708	0.93	0.57	NA	A9878	0.34	0.21
100-N	A4716	0.16	0.10	NA	A9882	0.88	0.53
300 AREA	A5018	6.9	4.2	NA	A9910	152	92
300 AREA	A5020	1.8	1.1	NA	B8074	1.05	0.64

[1] Not available; the operational area was not recorded for these wells.

Table 5-75. Rural Residential Groundwater Incremental Radiation Dose Results.

Operational Area	Well ID	RME Dose	CTE Dose	Operational Area	Well ID	RME Dose	CTE Dose
100-DDR	A4568	0.02	0.011	300 AREA	A5024	1.2	0.74
100-DDR	A4570	0.31	0.19	300 AREA	A5035	1.1	0.68
100-DDR	A4573	1.2	0.72	300 AREA	A5044	19	12
100-DDR	A4574	1.2	0.71	300 AREA	A5049	2.0	1.2
100-DDR	B8744	0	0	300 AREA	A5052	2.3	1.4
100-DDR	B8750	0.15	0.090	300 AREA	A5056	0	0
100-DDR	B8753	0.01	0.00	300 AREA	A8077	7.8	4.7
100-DDR	B8778	0.40	0.24	300 AREA	A8089	2.6	1.6
100-DDR	B8779	0.13	0.076	NA[1]	199-F5-42	0.30	0.18
100-F	A4600	2.3	1.4	NA	199-F5-43B	0.09	0.05
100-F	A4608	1.4	0.87	NA	199-F5-45	1.2	0.75
100-H	A4613	0.46	0.28	NA	199-F5-47	1.3	0.80
100-H	A4614	0	0	NA	199-F5-48	0.90	0.55
100-H	A4619	4.9	3.0	NA	199-F7-1	0.72	0.44
100-H	A4626	1.2	0.71	NA	199-F7-2	1.1	0.70
100-H	A4630	2.1	1.3	NA	199-F7-3	1.2	0.74
100-H	A4632	0.70	0.42	NA	199-H4-48	0	0
100-H	A4636	0.68	0.42	NA	199-K-22	5.2	3.2
100-H	A4641	0.09	0.05	NA	199-N-70	0.82	0.50
100-H	A4642	1.5	0.89	NA	199-N-80	1.6	0.95
100-K	399-4-9	13	7.7	NA	A4587	5.9	3.6
100-K	A4653	1.9	1.2	NA	A4647	1.8	1.1
100-K	A4660	9.9	6.0	NA	A4649	0.92	0.56
100-K	A4662	0.70	0.43	NA	A4650	11	6.3
100-K	C4670	10	6.0	NA	A4657	1.2	0.75
100-N	A4665	0	0	NA	A4677	5.2	3.2
100-N	A4675	0	0	NA	A4681	1.3	0.78
100-N	A4679	116	71	NA	A4717	0.43	0.26
100-N	A4708	0.60	0.36	NA	A9878	0.34	0.21
100-N	A4716	0	0	NA	A9882	0.55	0.33
300 AREA	A5018	6.6	4.0	NA	A9910	152	92
300 AREA	A5020	1.5	0.89	NA	B8074	0.72	0.44

[1] Not available; the operational area was not recorded for these wells.

Table 5-76. Rural Residential Child: Groundwater Total Chemical Hazard Results.

Operational Area	Well ID	RME HI	CTE HI	Operational Area	Well ID	RME HI	CTE HI
100-DDR	A4568	1.8	0.63	300 AREA	A5024	4.9	2.4
100-DDR	A4570	9.2	3.2	300 AREA	A5035	5.4	2.6
100-DDR	A4573	1.9	0.68	300 AREA	A5044	3.4	1.3
100-DDR	A4574	1.1	0.44	300 AREA	A5049	2.0	0.74
100-DDR	B8744	5.5	1.9	300 AREA	A5052	1.6	0.65
100-DDR	B8750	4.0	1.3	300 AREA	A5056	0	0
100-DDR	B8753	18	6.1	300 AREA	A8077	8.2	3.3
100-DDR	B8778	18	6.2	300 AREA	A8089	3.2	1.3
100-DDR	B8779	0.7	0.26	NA[1]	199-F5-42	0.59	0.23
100-F	A4600	2.1	0.72	NA	199-F5-43B	1.1	0.42
100-F	A4608	1.9	0.82	NA	199-F5-45	1.6	0.56
100-H	A4613	2.8	1.2	NA	199-F5-47	1.1	0.41
100-H	A4614	520	294	NA	199-F5-48	1.1	0.47
100-H	A4619	1.4	0.67	NA	199-F7-1	3.3	1.1
100-H	A4626	1.4	0.50	NA	199-F7-2	3.0	1.0
100-H	A4630	2.2	0.77	NA	199-F7-3	3.3	1.2
100-H	A4632	2.5	0.88	NA	199-H4-48	0.58	0.22
100-H	A4636	0.8	0.28	NA	199-K-22	5.7	2.7
100-H	A4641	1.2	0.44	NA	199-N-70	1.5	0.54
100-H	A4642	2.4	0.86	NA	199-N-80	4.7	1.6
100-K	399-4-9	3.9	1.5	NA	A4587	6.1	3.1
100-K	A4653	18	9.1	NA	A4647	9.3	4.1
100-K	A4660	1.5	0.58	NA	A4649	5.8	2.5
100-K	A4662	3.0	1.1	NA	A4650	0.84	0.30
100-K	C4670	4.2	1.4	NA	A4657	1.6	0.60
100-N	A4665	12	4.8	NA	A4677	2.5	1.2
100-N	A4675	43	14	NA	A4681	1.2	0.43
100-N	A4679	0.5	0.17	NA	A4717	0.56	0.24
100-N	A4708	1.9	0.62	NA	A9878	0.32	0.15
100-N	A4716	7.1	2.5	NA	A9882	0.71	0.27
300 AREA	A5018	2.7	1.1	NA	A9910	0.29	0.15
300 AREA	A5020	6.8	2.4	NA	B8074	1.7	0.60

[1] Not available; the operational area was not recorded for these wells.

Table 5-77. Rural Residential Groundwater Child Chemical Hazard Index: Ratio of Background and Total HI Values.

Operational Area	Well ID	RME bckgrd / total HI	CTE bckgrd / total HI	Operational Area	Well ID	RME bckgrd / total HI	CTE bckgrd / total HI
100-DDR	A4568	0.29	0.27	300 AREA	A5024	0.19	0.13
100-DDR	A4570	0.03	0.02	300 AREA	A5035	0.17	0.12
100-DDR	A4573	0.12	0.11	300 AREA	A5044	0.20	0.17
100-DDR	A4574	0.21	0.18	300 AREA	A5049	0.26	0.24
100-DDR	B8744	0.17	0.16	300 AREA	A5052	0.31	0.26
100-DDR	B8750	0.06	0.06	300 AREA	A5056	0	0
100-DDR	B8753	0.03	0.03	300 AREA	A8077	0.15	0.13
100-DDR	B8778	0.01	0.01	300 AREA	A8089	0.18	0.15
100-DDR	B8779	0.32	0.29	NA[1]	199-F5-42	0.44	0.38
100-F	A4600	0.13	0.12	NA	199-F5-43B	0.44	0.39
100-F	A4608	0.11	0.09	NA	199-F5-45	0.17	0.17
100-H	A4613	0.19	0.14	NA	199-F5-47	0.24	0.23
100-H	A4614	<0.01	<0.01	NA	199-F5-48	0.25	0.20
100-H	A4619	0.16	0.11	NA	199-F7-1	0.29	0.28
100-H	A4626	0.38	0.34	NA	199-F7-2	0.32	0.31
100-H	A4630	1.0	1.0	NA	199-F7-3	0.27	0.25
100-H	A4632	0.20	0.20	NA	199-H4-48	0.45	0.39
100-H	A4636	0.27	0.27	NA	199-K-22	0.05	0.03
100-H	A4641	0.44	0.40	NA	199-N-70	0.36	0.34
100-H	A4642	0.24	0.22	NA	199-N-80	0.19	0.19
100-K	399-4-9	0.25	0.21	NA	A4587	0.03	0.02
100-K	A4653	0.03	0.02	NA	A4647	0.06	0.04
100-K	A4660	0.35	0.30	NA	A4649	0.04	0.03
100-K	A4662	0.31	0.27	NA	A4650	0.28	0.26
100-K	C4670	0.12	0.12	NA	A4657	0.33	0.29
100-N	A4665	0.02	0.02	NA	A4677	0.09	0.06
100-N	A4675	0.09	0.09	NA	A4681	0.18	0.17
100-N	A4679	0.44	0.44	NA	A4717	0.40	0.31
100-N	A4708	0.33	0.33	NA	A9878	0.66	0.47
100-N	A4716	0.23	0.21	NA	A9882	0.05	0.05
300 AREA	A5018	0.35	0.30	NA	A9910	0.68	0.44
300 AREA	A5020	0.24	0.22	NA	B8074	0.30	0.29

[1] Not available; the operational area was not recorded for these wells.

Table 5-78. Resident Monument Worker Groundwater Total Risk Results.

Operational Area	Well ID	RME Cancer Risk	CTE Cancer Risk	Operational Area	Well ID	RME Cancer Risk	CTE Cancer rIsk
100-D	A4568	9.E-05	1.E-05	300 AREA	A5024	3.E-04	5.E-05
100-D	A4570	3.E-05	6.E-06	300 AREA	A5035	3.E-04	6.E-05
100-D	A4573	5.E-05	7.E-06	300 AREA	A5044	2.E-04	3.E-05
100-D	A4574	6.E-05	1.E-05	300 AREA	A5049	2.E-04	3.E-05
100-D	B8744	2.E-05	3.E-06	300 AREA	A5052	1.E-04	2.E-05
100-D	B8750	5.E-06	7.E-07	300 AREA	A5056	0.E+00	0.E+00
100-D	B8753	7.E-05	1.E-05	300 AREA	A8077	3.E-04	4.E-05
100-D	B8778	2.E-05	4.E-06	300 AREA	A8089	2.E-04	4.E-05
100-D	B8779	1.E-05	2.E-06	NA[1]	199-F5-42	1.E-05	2.E-06
100-F	A4600	3.E-05	6.E-06	NA	199-F5-43B	1.E-05	2.E-06
100-F	A4608	8.E-05	1.E-05	NA	199-F5-45	2.E-05	3.E-06
100-H	A4613	1.E-04	2.E-05	NA	199-F5-47	3.E-05	4.E-06
100-H	A4614	4.E-03	7.E-04	NA	199-F5-48	4.E-05	6.E-06
100-H	A4619	1.E-04	2.E-05	NA	199-F7-1	2.E-04	3.E-05
100-H	A4626	1.E-04	2.E-05	NA	199-F7-2	1.E-04	2.E-05
100-H	A4630	1.E-04	2.E-05	NA	199-F7-3	2.E-04	3.E-05
100-H	A4632	1.E-04	2.E-05	NA	199-H4-48	2.E-05	2.E-06
100-H	A4636	1.E-05	2.E-06	NA	199-K-22	1.E-04	2.E-05
100-H	A4641	9.E-05	1.E-05	NA	199-N-70	2.E-04	2.E-05
100-H	A4642	2.E-04	3.E-05	NA	199-N-80	2.E-04	3.E-05
100-K	399-4-9	3.E-04	4.E-05	NA	A4587	2.E-04	4.E-05
100-K	A4653	5.E-04	9.E-05	NA	A4647	3.E-04	5.E-05
100-K	A4660	3.E-04	5.E-05	NA	A4649	1.E-04	2.E-05
100-K	A4662	2.E-04	3.E-05	NA	A4650	2.E-04	3.E-05
100-K	C4670	3.E-04	5.E-05	NA	A4657	2.E-04	3.E-05
100-N	A4665	2.E-04	4.E-05	NA	A4677	3.E-04	4.E-05
100-N	A4675	2.E-04	4.E-05	NA	A4681	7.E-05	1.E-05
100-N	A4679	1.E-03	2.E-04	NA	A4717	3.E-05	5.E-06
100-N	A4708	3.E-05	5.E-06	NA	A9878	2.E-05	4.E-06
100-N	A4716	2.E-04	3.E-05	NA	A9882	2.E-05	3.E-06
300 AREA	A5018	2.E-04	3.E-05	NA	A9910	2.E-03	3.E-04
300 AREA	A5020	2.E-04	2.E-05	NA	B8074	1.E-04	2.E-05

[1] Not available; the operational area was not recorded for these wells.

Table 5-79. Resident Monument Worker Groundwater ILCR Results.

Operational Area	Well ID	RME ILCR	CTE ILCR	Operational Area	Well ID	RME ILCR	CTE ILCR
100-D	A4568	6.E-05	9.E-06	300 AREA	A5024	3.E-04	5.E-05
100-D	A4570	3.E-05	5.E-06	300 AREA	A5035	3.E-04	5.E-05
100-D	A4573	4.E-05	7.E-06	300 AREA	A5044	2.E-04	3.E-05
100-D	A4574	6.E-05	9.E-06	300 AREA	A5049	1.E-04	2.E-05
100-D	B8744	1.E-05	2.E-06	300 AREA	A5052	1.E-04	2.E-05
100-D	B8750	2.E-06	3.E-07	300 AREA	A5056	0.E+00	0.E+00
100-D	B8753	4.E-05	7.E-06	300 AREA	A8077	2.E-04	4.E-05
100-D	B8778	2.E-05	4.E-06	300 AREA	A8089	2.E-04	3.E-05
100-D	B8779	8.E-06	1.E-06	NA[1]	199-F5-42	1.E-05	2.E-06
100-F	A4600	3.E-05	5.E-06	NA	199-F5-43B	1.E-05	2.E-06
100-F	A4608	8.E-05	1.E-05	NA	199-F5-45	2.E-05	3.E-06
100-H	A4613	1.E-04	2.E-05	NA	199-F5-47	2.E-05	4.E-06
100-H	A4614	4.E-03	7.E-04	NA	199-F5-48	4.E-05	6.E-06
100-H	A4619	1.E-04	2.E-05	NA	199-F7-1	1.E-04	2.E-05
100-H	A4626	8.E-05	1.E-05	NA	199-F7-2	1.E-04	2.E-05
100-H	A4630	9.E-05	1.E-05	NA	199-F7-3	1.E-04	2.E-05
100-H	A4632	1.E-04	2.E-05	NA	199-H4-48	1.E-05	2.E-06
100-H	A4636	1.E-05	2.E-06	NA	199-K-22	1.E-04	2.E-05
100-H	A4641	5.E-05	9.E-06	NA	199-N-70	1.E-04	2.E-05
100-H	A4642	1.E-04	2.E-05	NA	199-N-80	1.E-04	2.E-05
100-K	399-4-9	2.E-04	4.E-05	NA	A4587	2.E-04	4.E-05
100-K	A4653	5.E-04	8.E-05	NA	A4647	3.E-04	4.E-05
100-K	A4660	3.E-04	4.E-05	NA	A4649	1.E-04	2.E-05
100-K	A4662	2.E-04	3.E-05	NA	A4650	2.E-04	3.E-05
100-K	C4670	3.E-04	4.E-05	NA	A4657	1.E-04	2.E-05
100-N	A4665	2.E-04	4.E-05	NA	A4677	3.E-04	4.E-05
100-N	A4675	2.E-04	3.E-05	NA	A4681	7.E-05	1.E-05
100-N	A4679	1.E-03	2.E-04	NA	A4717	3.E-05	4.E-06
100-N	A4708	3.E-05	5.E-06	NA	A9878	2.E-05	4.E-06
100-N	A4716	2.E-04	3.E-05	NA	A9882	2.E-05	3.E-06
300 AREA	A5018	1.E-04	2.E-05	NA	A9910	2.E-03	3.E-04
300 AREA	A5020	1.E-04	2.E-05	NA	B8074	1.E-04	2.E-05

[1] Not available; the operational area was not recorded for these wells.

Table 5-80. Resident Monument Worker Groundwater Total Radiation Dose Results.

Operational Area	Well ID	RME Dose	CTE Dose	Operational Area	Well ID	RME Dose	CTE Dose
100-DDR	A4568	0.35	0.21	300 AREA	A5024	1.5	0.94
100-DDR	A4570	0.64	0.39	300 AREA	A5035	1.5	0.88
100-DDR	A4573	1.5	0.92	300 AREA	A5044	19	12
100-DDR	A4574	1.5	0.91	300 AREA	A5049	2.4	1.4
100-DDR	B8744	0.19	0.12	300 AREA	A5052	2.6	1.6
100-DDR	B8750	0.48	0.29	300 AREA	A5056	0	0
100-DDR	B8753	0.34	0.21	300 AREA	A8077	8.1	5.0
100-DDR	B8778	0.73	0.44	300 AREA	A8089	3.0	1.8
100-DDR	B8779	0.46	0.28	NA[1]	199-F5-42	0.63	0.38
100-F	A4600	2.6	1.6	NA	199-F5-43B	0.41	0.25
100-F	A4608	1.8	1.1	NA	199-F5-45	1.6	0.95
100-H	A4613	0.46	0.28	NA	199-F5-47	1.7	1.0
100-H	A4614	0.31	0.19	NA	199-F5-48	1.2	0.75
100-H	A4619	5.2	3.2	NA	199-F7-1	1.0	0.64
100-H	A4626	1.5	0.91	NA	199-F7-2	1.5	0.90
100-H	A4630	2.4	1.5	NA	199-F7-3	1.6	0.95
100-H	A4632	1.0	0.63	NA	199-H4-48	0.30	0.14
100-H	A4636	1.0	0.62	NA	199-K-22	5.6	3.4
100-H	A4641	0.26	0.16	NA	199-N-70	1.1	0.70
100-H	A4642	1.8	1.1	NA	199-N-80	1.9	1.2
100-K	399-4-9	13	7.9	NA	A4587	6.2	3.8
100-K	A4653	2.3	1.4	NA	A4647	2.0	1.2
100-K	A4660	10	6.2	NA	A4649	1.3	0.76
100-K	A4662	1.0	0.63	NA	A4650	11	6.5
100-K	C4670	10	6.2	NA	A4657	1.6	0.95
100-N	A4665	0.18	0.11	NA	A4677	5.5	3.4
100-N	A4675	0.22	0.13	NA	A4681	1.7	0.98
100-N	A4679	117	71	NA	A4717	0.76	0.46
100-N	A4708	0.93	0.57	NA	A9878	0.34	0.21
100-N	A4716	0.16	0.10	NA	A9882	0.88	0.53
300 AREA	A5018	6.9	4.2	NA	A9910	152	92
300 AREA	A5020	1.8	1.1	NA	B8074	1.0	0.64

[1] Not available; the operational area was not recorded for these wells.

Table 5-81. Resident Monument Worker Groundwater Incremental Radiation Dose Results.

Operational Area	Well ID	RME Dose	CTE Dose	Operational Area	Well ID	RME Dose	CTE Dose
100-DDR	A4568	0.02	0.011	300 AREA	A5024	1.2	0.74
100-DDR	A4570	0.31	0.19	300 AREA	A5035	1.1	0.68
100-DDR	A4573	1.2	0.72	300 AREA	A5044	19	12
100-DDR	A4574	1.2	0.71	300 AREA	A5049	2.0	1.2
100-DDR	B8744	0	0	300 AREA	A5052	2.3	1.4
100-DDR	B8750	0.15	0.090	300 AREA	A5056	0	0
100-DDR	B8753	0.01	0.00	300 AREA	A8077	7.8	4.7
100-DDR	B8778	0.40	0.24	300 AREA	A8089	2.6	1.6
100-DDR	B8779	0.13	0.076	NA[1]	199-F5-42	0.30	0.18
100-F	A4600	2.3	1.4	NA	199-F5-43B	0.09	0.05
100-F	A4608	1.4	0.87	NA	199-F5-45	1.2	0.75
100-H	A4613	0.46	0.28	NA	199-F5-47	1.3	0.80
100-H	A4614	0	0	NA	199-F5-48	0.90	0.55
100-H	A4619	4.9	3.0	NA	199-F7-1	0.72	0.44
100-H	A4626	1.2	0.71	NA	199-F7-2	1.1	0.70
100-H	A4630	2.1	1.3	NA	199-F7-3	1.2	0.74
100-H	A4632	0.70	0.42	NA	199-H4-48	0	0
100-H	A4636	0.68	0.42	NA	199-K-22	5.2	3.2
100-H	A4641	0.09	0.05	NA	199-N-70	0.82	0.50
100-H	A4642	1.5	0.89	NA	199-N-80	1.6	0.95
100-K	399-4-9	13	7.7	NA	A4587	5.9	3.6
100-K	A4653	1.9	1.2	NA	A4647	1.8	1.1
100-K	A4660	9.9	6.0	NA	A4649	0.92	0.56
100-K	A4662	0.70	0.43	NA	A4650	11	6.3
100-K	C4670	10	6.0	NA	A4657	1.2	0.75
100-N	A4665	0	0	NA	A4677	5.2	3.2
100-N	A4675	0	0	NA	A4681	1.3	0.78
100-N	A4679	116	71	NA	A4717	0.43	0.26
100-N	A4708	0.60	0.36	NA	A9878	0.34	0.21
100-N	A4716	0	0	NA	A9882	0.55	0.33
300 AREA	A5018	6.6	4.0	NA	A9910	152	92
300 AREA	A5020	1.5	0.89	NA	B8074	0.72	0.44

[1] Not available; the operational area was not recorded for these wells.

Table 5-82. Resident Monument Worker Groundwater Total Chemical Hazard Results.

Operational Area	Well ID	RME HI	CTE HI	Operational Area	Well ID	RME HI	CTE HI
100-DDR	A4568	1.2	0.70	300 AREA	A5024	2.8	1.8
100-DDR	A4570	5.9	3.6	300 AREA	A5035	3.1	2.0
100-DDR	A4573	1.2	0.74	300 AREA	A5044	2.1	1.3
100-DDR	A4574	0.71	0.44	300 AREA	A5049	1.3	0.78
100-DDR	B8744	3.5	2.2	300 AREA	A5052	1.0	0.63
100-DDR	B8750	2.6	1.6	300 AREA	A5056	0	0
100-DDR	B8753	11.8	7.2	300 AREA	A8077	5.0	3.1
100-DDR	B8778	11.9	7.2	300 AREA	A8089	2.0	1.2
100-DDR	B8779	0.43	0.26	NA[1]	199-F5-42	0.37	0.23
100-F	A4600	1.3	0.81	NA	199-F5-43B	0.69	0.42
100-F	A4608	1.1	0.69	NA	199-F5-45	1.0	0.63
100-H	A4613	1.6	1.0	NA	199-F5-47	0.73	0.45
100-H	A4614	277	181	NA	199-F5-48	0.66	0.41
100-H	A4619	0.80	0.51	NA	199-F7-1	2.2	1.3
100-H	A4626	0.87	0.54	NA	199-F7-2	1.9	1.2
100-H	A4630	1.4	0.86	NA	199-F7-3	2.1	1.3
100-H	A4632	1.6	1.0	NA	199-H4-48	0.35	0.20
100-H	A4636	0.54	0.33	NA	199-K-22	3.3	2.1
100-H	A4641	0.75	0.46	NA	199-N-70	1.0	0.60
100-H	A4642	1.5	0.93	NA	199-N-80	3.1	1.9
100-K	399-4-9	2.4	1.5	NA	A4587	3.4	2.2
100-K	A4653	10	6.4	NA	A4647	5.5	3.5
100-K	A4660	0.92	0.57	NA	A4649	3.4	2.2
100-K	A4662	1.9	1.1	NA	A4650	0.51	0.29
100-K	C4670	2.6	1.5	NA	A4657	1.0	0.60
100-N	A4665	7.1	4.4	NA	A4677	1.4	0.88
100-N	A4675	28	17	NA	A4681	0.79	0.45
100-N	A4679	0.33	0.20	NA	A4717	0.34	0.21
100-N	A4708	1.2	0.74	NA	A9878	0.19	0.12
100-N	A4716	4.5	2.8	NA	A9882	0.44	0.27
300 AREA	A5018	1.7	1.0	NA	A9910	0.17	0.11
300 AREA	A5020	4.3	2.7	NA	B8074	1.1	0.66

[1] Not available; the operational area was not recorded for these wells.

Table 5-83. Resident Monument Worker Groundwater Chemical Hazard Index: Ratio of Background and Total HI Values.

Operational Area	Well ID	RME bckgrd / total HI	CTE bckgrd / total HI	Operational Area	Well ID	RME bckgrd / total HI	CTE bckgrd / total HI
100-DDR	A4568	0.29	0.29	300 AREA	A5024	0.21	0.20
100-DDR	A4570	0.03	0.03	300 AREA	A5035	0.19	0.19
100-DDR	A4573	0.13	0.13	300 AREA	A5044	0.21	0.20
100-DDR	A4574	0.22	0.21	300 AREA	A5049	0.27	0.27
100-DDR	B8744	0.17	0.17	300 AREA	A5052	0.33	0.33
100-DDR	B8750	0.06	0.06	300 AREA	A5056	0	0
100-DDR	B8753	0.03	0.03	300 AREA	A8077	0.16	0.16
100-DDR	B8778	0.01	0.01	300 AREA	A8089	0.18	0.18
100-DDR	B8779	0.34	0.33	NA[1]	199-F5-42	0.46	0.46
100-F	A4600	0.13	0.13	NA	199-F5-43B	0.46	0.46
100-F	A4608	0.13	0.12	NA	199-F5-45	0.18	0.18
100-H	A4613	0.21	0.20	NA	199-F5-47	0.25	0.25
100-H	A4614	<0.01	<0.01	NA	199-F5-48	0.27	0.27
100-H	A4619	0.18	0.17	NA	199-F7-1	0.29	0.29
100-H	A4626	0.39	0.38	NA	199-F7-2	0.32	0.32
100-H	A4630	>1.0	>1.0	NA	199-F7-3	0.28	0.28
100-H	A4632	0.21	0.20	NA	199-H4-48	0.49	0.52
100-H	A4636	0.27	0.27	NA	199-K-22	0.05	0.05
100-H	A4641	0.45	0.44	NA	199-N-70	0.37	0.37
100-H	A4642	0.24	0.24	NA	199-N-80	0.19	0.19
100-K	399-4-9	0.26	0.25	NA	A4587	0.04	0.04
100-K	A4653	0.03	0.03	NA	A4647	0.06	0.06
100-K	A4660	0.37	0.36	NA	A4649	0.04	0.04
100-K	A4662	0.32	0.31	NA	A4650	0.30	0.32
100-K	C4670	0.13	0.14	NA	A4657	0.34	0.34
100-N	A4665	0.02	0.02	NA	A4677	0.10	0.10
100-N	A4675	0.09	0.09	NA	A4681	0.18	0.19
100-N	A4679	0.44	0.44	NA	A4717	0.43	0.42
100-N	A4708	0.33	0.33	NA	A9878	0.73	0.70
100-N	A4716	0.23	0.23	NA	A9882	0.05	0.05
300 AREA	A5018	0.37	0.36	NA	A9910	0.78	0.74
300 AREA	A5020	0.24	0.24	NA	B8074	0.31	0.31

6.0 ECOLOGICAL RISK ASSESSMENT

6.1 OVERVIEW

This section describes the ecological risk assessment methods and results for the 100 Area and 300 Area Component of the RCBRA. This material was developed in accordance with the approved planning and decision documentation for the 100 Area and 300 Area Component of the RCBRA (e.g., DQO [BHI-01757], risk assessment work plan [DOE/RL-2004-37], and SAP [DOE/RL-2005-42]) and reflects input received during numerous public workshops conducted with the Hanford Natural Resource Trustees, the Tri-Party Agencies, the Hanford Advisory Board, and others. The assessment endpoints and associated measures, data inputs, analyses, and exposure calculations for the terrestrial/upland, riparian, and near-shore aquatic data from the 100 Area and 300 Area are described herein. In addition, as indicated in the Ecology approval letter for the SAP, certain elements of the assessment methods required further development including uncertainty analyses, reference sites, and risk integration. These and other topics were covered in regulator/trustee workshops conducted from July 2006 to May 2007, and workshop notes are provided in Appendix D. Presentation materials from these workshops are available on the worldwide web (http://www.washingtonclosure.com/Projects/EndState/100-300_comp.html). This risk assessment report reflects the input and recommendations from these workshops.

6.2 PROBLEM FORMULATION

The primary ecological risk assessment (ERA) goal for CERCLA sites is to reduce ecological risks to levels that will result in the recovery and maintenance of healthy local populations and communities of biota (EPA 1999b). The specific purpose of this ERA is to characterize potentially adverse effects on plants and animals that may be posed by residual, post-remediation contaminants at the Hanford Site. In addition, management goals for the River Corridor include considering impacts to state or federally listed threatened or endangered species, protecting rare habitats, and minimizing contaminant loading (or bioaccumulation) into biota (BHI-01757).

The characterization of ecological risks is structured around upland, riparian, and near-shore exposure zones in accord with the assessment endpoints developed for these environments. To limit repetition of information from earlier sections, components of the problem formulation presented elsewhere (e.g., site description and the ecological conceptual model, Section 2.0) are discussed only briefly here.

6.2.1 Ecological Assessment Endpoints

Assessment endpoints were developed from ecological management goals, and an understanding of the Hanford Site such as the CEM and trophic relationships among ecological receptors. For example, the screening-level evaluation indicated a preponderance of inorganic and radionuclide contaminants. Because most inorganic chemicals (including most radionuclides) rarely concentrate in tissues through multiple trophic transfers (EPA 120/R-07/001), the potential for adverse effects on higher trophic-level organisms are generally of less concern than risks to organisms lower in the food web. Plants and invertebrates are valuable assessment endpoint entities because these organisms are intimately associated with soil and sediment and have high exposure potential (e.g., through dermal contact), making them ideal indicators for evaluating the adverse effects of soluble contaminants. To the extent that inorganics do accumulate in biotic tissues, there is a greater propensity for them to be taken up by invertebrates compared to plants (WAC 173-340-900, Table 749-5). Relative to plant-eating wildlife (or to wildlife that eat a variety of foodstuffs), therefore, receptors feeding on invertebrates should experience relatively greater exposure to radionuclides and metals and are a focal group for assessment of ecological risk.

EPA guidance defines assessment endpoints as an entity and attributes of this entity. Assessment endpoint entities have been selected as representative species in a simplified food web. Thus, species are intended to be representative of biota potentially at risk from contaminants within and between exposure zones. These representative species address key management goals and stakeholder concerns. Assessment endpoint attributes are discussed in the following section (Section 6.2.2). For the terrestrial upland and riparian environments, this includes lower trophic-level producers (including T&E species[1]), invertebrates, and middle and upper trophic-level birds and mammals.

Representative Terrestrial Upland and Riparian Receptors

- Lower trophic level
  Generic plants and soil invertebrates

- Middle trophic level
  Herbivores: Pocket mouse and mourning dove
  Omnivores: Deer mouse and meadowlark
  Invertivores: Grasshopper mouse, side-blotched lizard, killdeer, eastern and western kingbird

- Upper trophic level
  Carnivores: Gopher snake, badger, red-tailed hawk

Receptors in the near-shore aquatic environment include plants; herbivorous invertebrates and vertebrates; omnivorous invertebrates, fish, birds, and mammals; invertivorous (invertebrate-eating) amphibians, fish, birds, and mammals; and carnivorous fish, birds, and mammals. It is important to note that some of the near-shore aquatic species actually have different feeding strategies during their life history stages. Examples of this include the different diet and environments preferred by amphibians during juvenile development from eggs to tadpoles and to the adult stage.

[1] T&E plant species include persistent sepal yellowcress (*Rorippa columbiae*), lowland toothcup (*Rotala ramosior*), and awned halfchaff sedge (*Lipocarpha aristulata*).

Representative Near-Shore Aquatic Receptors

- Lower trophic level
  Generic plants, aquatic insects, snails, and Asiatic clam

- Middle trophic level
  Herbivores: Mallard duck
  Omnivores: Carp
  Invertivores: Woodhouse's toad, sculpin, bufflehead duck, eastern and western kingbird and Myotis bat

- Upper trophic level
  Carnivores: Salmon, Great Blue heron, and terrestrial receptors drinking from the river

In some cases, risk inferences are based on maximally exposed representative receptors acting as surrogates for other species in the same taxonomic group. For example, herbivorous mallards are a representative species selected in the course of developing project DQOs; they are represented by invertebrate-eating bufflehead ducks given this receptor's higher exposure potential. Similarly, sculpin are protective representatives of T&E salmonids due to their year-round exposure duration and relatively limited home range (McCleave 1964, Hill and Grossman 1987, Morgan and Ringler 1992, Gray et al. 2004). While some representative receptors are unique to one type of environment, such as fish in the near-shore aquatic area, others can traverse multiple environments in the course of daily foraging activities; e.g., broad-ranging red-tailed hawks capturing mammalian prey at upland remediated waste sites or riparian operational areas and using the river as a source of drinking water.

6.2.2 Ecological Risk Questions

Risk questions for the upland, riparian, and aquatic near-shore environments focus the investigation on components of the ecosystem that have the greatest potential for exposure to Hanford Site-related contaminants. These questions were initially developed as part of the DQO process (BHI-01757) and are summarized for the upland zone, riparian zone, and near-shore aquatic zone. These questions provide the broad list of assessment endpoint attributes evaluated in this report.

Upland Zone. Terrestrial upland risk questions were developed to determine if COPCs in the soil may potentially adversely affect the assessment endpoints. The questions for the upland zone are as follows:

- Do contaminant concentrations in shallow zone soils decrease plant survival or growth?

- Do contaminant concentrations in shallow-zone soils affect soil macroinvertebrate survival, growth, abundance, or diversity?

- Do contaminant concentrations in shallow zone soils and food decrease middle trophic-level (herbivorous, insectivorous, or omnivorous) species (lizard, bird, and mammal) survival, growth, reproduction, relative abundance, juvenile recruitment, or affect balanced gender ratios?

- Do contaminant concentrations in shallow zone soils and food decrease carnivorous bird or mammal survival, growth, or reproduction?

The terrestrial upland risk questions can be evaluated as a series of hypotheses that lend themselves to development of rules for decision making. The following terrestrial risk hypotheses were developed as part of the DQO process (BHI-01757) to address screening data gaps and form the basis for COPC refinement and the selection of assessment endpoints and associated measures. It is important to note that beyond the screening assessment which used comparisons to abiotic media benchmarks, ecological risk characterizations employ a WOE evaluation of the potential for adverse ecological effects with an emphasis on collecting site-specific data. The results of testing hypothesis 1, based on general literature values, are consequently given less weight than results from testing hypotheses 2 through 9, which are evaluated using data collected in the study design to determine if contaminant concentrations in Hanford Site soil adversely affect the terrestrial assessment endpoints.

The focus of this investigation is on remediated waste sites. These post-remediation conditions are represented by inclusion of the vegetated areas around the perimeter of remediated waste sites. Recognition of existing conditions underlies the hypothesis testing structure. For example, the null hypothesis, which has been stated as the condition that may be refuted with additional data collection, is that soil contaminant concentrations are not associated with adverse effects. This hypothesis is tested based on multiple lines of evidence (LOEs), and these findings are evaluated using a WOE approach as described below.

Hypothesis 1: Terrestrial Upland Contaminant Assessment

This hypothesis is formulated for comparison of concentrations to soil benchmarks:

- Null: Mean remediated waste site contaminant concentrations are not greater than soil benchmarks (benchmark values were compiled for the 100-B/C Pilot Project risk assessment [DOE/RL-2005-40] and augmented with values from the Los Alamos National Laboratory's EcoRisk Database [LANL 2005]).

- Alternate: Mean remediated waste site concentrations are greater than soil benchmarks.

All of the other risk hypotheses are based on a design with contaminant gradient and reference site. Each hypothesis includes a comparison to reference site conditions and an assessment of the contaminant gradient. Based on feedback received from various parties during the regulator and trustee workshops, greater weight in the WOE analysis is attributed to the results of the gradient analysis compared to the reference site analysis. Tissue concentrations and diet concentrations are also compared to adverse effect levels as another LOE for hypotheses 7 and 8. A more detailed linkage between hypotheses and the terrestrial assessment endpoint entities is presented in the DQO Summary Report (BHI-01757). The following risk hypotheses are stated generically for a receptor, with receptors replaced by the representative species for each assessment endpoint entity.

Hypothesis 2: Survival and Growth

Gradient analysis:

- Null. Mean survival or growth of receptor does not decrease along a gradient of increasing contaminant concentrations.
- Alternate. Mean survival or growth of receptor decreases along a gradient of increasing contaminant concentrations.

Reference site comparison:

- Null. Mean survival or growth of receptor is not less on remediated waste sites compared to reference sites.
- Alternate. Mean survival or growth of receptor is less on remediated waste sites than in the reference sites.

Hypothesis 3: Species Diversity

Gradient analysis:

- Null. Species diversity of receptor does not decrease along a gradient with increasing contaminant concentrations for the same habitat type.
- Alternate. Species diversity of receptor decreases along a gradient with increasing contaminant concentrations for the same habitat type.

Reference site comparison:

- Null. Species diversity of receptors on remediated waste sites is not less than in the reference sites for the same habitat type.
- Alternate. Species diversity of receptor is less on remediated waste sites than in the reference sites for the same habitat type.

Hypothesis 4: Relative Population Abundance

Gradient analysis:

- Null. Relative population abundance of receptor does not decrease along a gradient with increasing contaminant concentrations for the same habitat type.

- Alternate. Relative population abundance of receptor decreases along a gradient with increasing contaminant concentrations for the same habitat type.

Reference site comparison:

- Null. Relative population abundance of receptor on remediated waste sites is not less than in the reference sites for the same habitat type (e.g., remediated and backfilled waste site).
- Alternate. Relative population abundance of receptor on remediated waste sites is less than in the reference sites for the same habitat type.

Hypothesis 5: Reproductive Rates

Gradient analysis:

- Null. Receptor reproductive rates do not decrease along a gradient with increasing contaminant concentrations for the same habitat type.
- Alternate. Receptor reproductive rates are less than those in the reference site or decrease along a gradient with increasing contaminant concentrations for the same habitat type.

Reference site comparison:

- Null. Receptor reproductive rates are not less on remediated waste sites than those in the reference sites for the same habitat type.
- Alternate. Receptor reproductive rates are less on remediated waste sites than those in the reference sites for the same habitat type.

Hypothesis 6: Gender Ratios

Gradient analysis:

- Null. Receptor gender ratios do not deviate from equality along a gradient with increasing contaminant concentrations for the same habitat type.
- Alternate. Receptor gender ratios increasingly deviate from equality along a gradient with increasing contaminant concentrations for the same habitat type.

Reference site comparison:

- Null. Receptor gender ratios on remediated waste sites do not deviate from equality in comparison to the reference sites for the same habitat type.
- Alternate. Receptor gender ratios on remediated waste sites deviate from equality in comparison to the reference sites for the same habitat type.

Hypothesis 7: Contaminant Concentrations in Biota

Gradient analysis:

- Null. Mean contaminant tissue concentrations in the receptor do not increase along a gradient with increasing contaminant concentrations.

- Alternate. Mean contaminant tissue concentrations in the receptor increase along a gradient with increasing contaminant concentrations.

Reference site comparison:

- Null. Mean contaminant tissue concentrations in the receptor are not greater on remediated waste sites than in the reference sites.

- Alternate. Mean contaminant tissue concentrations in the receptor are greater on remediated waste sites than in the reference sites.

Comparison to no-effect levels:

- Null. Mean contaminant tissue concentrations in the receptor are not greater than those associated with no adverse effects (published levels are available for only selected contaminants such as PCBs and heavy metals [e.g., Eisler 1986, Eisler and Belisle 1996]).

- Alternate. Mean contaminant tissue concentrations in the receptor are greater than those associated with no adverse effects (published levels are available for only selected contaminants such as PCBs and heavy metals [e.g., Eisler 1986, Eisler and Belisle 1996]).

Hypothesis 8: Dietary Exposure

Gradient analysis:

- Null. Mean contaminant concentrations via dietary exposure to the receptor (via food and incidental soil ingestion) do not increase along a gradient with increasing contaminant concentrations.

- Alternate. Mean contaminant concentrations via dietary exposure to the receptor (via food and incidental soil ingestion) do increase along a gradient with increasing contaminant concentrations.

Reference site comparison:

- Null. Mean contaminant concentrations via dietary exposure to the receptor (via food and incidental soil ingestion) on remediated waste sites are not greater than those in the reference sites.

- Alternate. Mean contaminant concentrations via dietary exposure to the receptor (via food and incidental soil ingestion) are greater on remediated waste sites than those in the reference sites.

Comparison to no-effect levels:

- Null. Mean contaminant tissue concentrations via dietary exposure to the receptor (via food and incidental soil ingestion) are not greater than those associated with no adverse effects.
- Alternate. Mean contaminant tissue concentrations via dietary exposure to the receptor (via food and incidental soil ingestion) are greater than those associated with no adverse effects (published levels are available for most contaminants).

Hypothesis 9: Juvenile Recruitment

Juvenile recruitment is a measure of reproductive success that refers to the survival of young animals to a stage where they are reproductively capable of having offspring; in other words, recruitment from nonbreeding juvenile or subadult to the breeding adult population.

Gradient analysis:

- Null. Juvenile recruitment for receptor does not decrease along a gradient with increasing contaminant concentrations.
- Alternate. Juvenile recruitment for receptor decreases along a gradient with increasing contaminant concentrations.

Reference site comparison:

- Null. Juvenile recruitment of receptor on remediated waste sites is not less than recruitment in the reference sites.
- Alternate. Juvenile recruitment for receptor on remediated waste sites is less than recruitment in the reference sites.

Inferences about ecological effects on middle trophic-level birds and mammals are based on differences in field measures of abundance, reproduction, and skewed gender ratios or a combination of tissue/dietary concentrations and the literature-based adverse-effect levels. Because animal abundance fluctuates greatly, less credence will be afforded to differences based on abundance compared to observations concerning reproduction. Because they incorporate site-specific information, field measures will be given greater weight than measures such as literature toxicity data.

In addition to risk questions relating to ecological effects, data gaps or uncertainties from the ecological screening evaluation and contaminant refinement also need to be evaluated. For all contaminants, the adequacy of method detection limits have been evaluated by comparing method detection limits to screening benchmark values.

Riparian Zone. Risk questions for the riparian zone are the same as those developed for the upland zone with the exception that the exposure media for the riparian zone include benthic macroinvertebrates for some receptors. Also, the risk questions for the reference site comparison are revised to "operational areas" from "remediated waste sites." Riparian zone risk questions include an additional question to reflect the potential for exposure to terrestrial wildlife from the near-shore aquatic zone:

- Do contaminant concentrations in food decrease aerial insectivore survival, growth, reproduction, or relative abundance?

Near-Shore Aquatic Zone. The assessment of the near-shore aquatic zones (hereinafter referred to as "aquatic") is driven by risk questions representing the CEM of how contaminant stressors are most likely to affect the aquatic ecosystem. The risk questions are as follows:

- Do contaminant concentrations in sediments and pore water decrease plant survival or growth?
- Do contaminant concentrations in sediments and pore water affect benthic macroinvertebrate survival, reproduction or growth, diversity, and/or relative abundance?
- Do contaminant concentrations in sediments, pore water, and food decrease amphibian survival, growth, reproduction, or relative abundance?
- Do contaminant concentrations in sediments, pore water, and food decrease carnivorous fish, bird, or mammal survival, growth, or reproduction?
- Do contaminant concentrations in sediments, pore water, and tissue increase histopathological indicators of effect for clams or fish?

The risk questions that were posed for the aquatic environment can be evaluated as a series of hypotheses that lend themselves to development of rules for decision making. The following risk hypotheses have been developed to form the basis for contaminant refinement and the assessment endpoints and associated measures.

Hypothesis 1: Aquatic Contaminant Assessment

This hypothesis is formulated for comparison of concentrations to no-effect levels or toxicity benchmarks:

- Null: Mean contaminant concentrations in aquatic media (pore water and sediment) are not greater than medium-specific benchmarks.

- Alternate: Mean contaminant concentrations in aquatic media (pore water and sediment) are greater than medium-specific benchmarks.

The following risk hypotheses are stated generically for a receptor, with receptors replaced by the relevant species for each assessment endpoint. All of the risk hypotheses are based on a design with a contaminant concentration gradient and reference site comparison. Each hypothesis includes a comparison to reference site conditions and an assessment of the contaminant concentration's gradient. Tissue concentrations and dietary concentrations are also compared to literature-based adverse effect levels (benchmarks) as another LOE for hypotheses 5 and 6. A more detailed crosswalk between hypotheses and the aquatic assessment endpoint (receptor) is presented in the DQO Summary Report (BHI-01757).

Hypothesis 2: Survival, Reproduction, and Growth

Gradient analysis:

- Null. Mean survival, reproduction, or growth does not decrease along a gradient of increasing contaminant concentrations.
- Alternate. Mean survival, reproduction, or growth of receptor decreases along a gradient of increasing contaminant concentrations.

Reference site comparison:

- Null. Mean survival, reproduction, or growth of receptor for operational areas is not less than reference sites.
- Alternate. Mean survival, reproduction, or growth of receptor for operational areas is less than reference sites.

Hypothesis 3: Species Diversity

Gradient analysis:

- Null. Species diversity of receptor does not decrease along a gradient with increasing contaminant concentrations for the same habitat type.
- Alternate. Species diversity of receptor decreases along a gradient with increasing contaminant concentrations for the same habitat type.

Reference site comparison:

- Null. Species diversity of receptor is not less for operational areas than diversity in the reference sites for the same habitat type.

- Alternate. Species diversity of receptor is less for operational areas than diversity in the reference sites for the same habitat type.

Hypothesis 4: Relative Population Abundance

Gradient analysis:

- Null. Relative population abundance of receptor does not decrease along a gradient with increasing contaminant concentrations for the same habitat type.
- Alternate. Relative population abundance of receptor decreases along a gradient with increasing COPC concentrations for the same habitat type.

Reference site comparison:

- Null. Relative population abundance of receptor for operational areas is not less than abundance in the reference sites for the same habitat type.
- Alternate. Relative population abundance of receptor for operational areas is less than abundance in the reference sites for the same habitat type.

Hypothesis 5: Contaminant Concentrations in Biota

Gradient analysis:

- Null. Mean contaminant concentrations in receptor tissue do not increase along a gradient with increasing contaminant concentrations.
- Alternate. Mean contaminant concentrations in the receptor tissue increase along a gradient with increasing contaminant concentrations.

Reference site comparison:

- Null. Mean contaminant concentrations in receptor tissue for operational areas are not greater than those in the reference sites.
- Alternate. Mean contaminant concentrations in the receptor tissue for operational areas are greater than those in the reference sites.

Comparison to no-effect levels:

- Null. Mean contaminant tissue concentrations in the receptor are not greater than those associated with no adverse effects (published levels are available for only selected contaminants such as PCBs and heavy metals [e.g., Eisler 1986, Eisler and Belisle 1996]).
- Alternate. Mean contaminant tissue concentrations in the receptor are greater than those associated with no adverse effects.

Hypothesis 6: Dietary Exposure

Gradient analysis:

- Null. Mean contaminant exposure concentrations (via food, water, and incidental sediment ingestion) do not increase along a gradient with increasing contaminant concentrations.
- Alternate. Mean contaminant exposure concentrations (via food, water, and incidental sediment ingestion) increase along a gradient with increasing contaminant concentrations.

Reference site comparison:

- Null. Mean contaminant exposure concentrations for operational areas (via food, water, and incidental sediment ingestion) are not greater than those in the reference sites.
- Alternate. Mean contaminant exposure concentrations for operational areas (via food, water, and incidental sediment ingestion) are greater than those in the reference sites.

Comparison to no-effect levels:

- Null. Mean contaminant exposure concentrations for operational areas (via food, water and incidental sediment ingestion) are not greater than those associated with no adverse effects.
- Alternate. Mean contaminant exposure concentrations for operational areas (via food, water and incidental sediment ingestion) are greater than those associated with no adverse effects.

Hypothesis 7: Histopathological Measures of Tissue Damage

Gradient analysis:

- Null. Histopathological measures of tissue damage do not increase along a gradient of increasing contaminant concentrations.
- Alternate. Histopathological measures of tissue damage increase along a gradient of increasing contaminant concentrations.

Reference site comparison:

- Null. Histopathological measures of tissue damage for operational areas are not greater than reference sites.
- Alternate. Histopathological measures of tissue damage for operational areas are greater than reference sites.

6.3 RISK ANALYSIS

Ecological risk assessment guidance from EPA indicates that a variety of measures are evaluated for each assessment endpoint. These measures constitute the LOEs in this risk assessment and include measures of exposure, measures of effect, and measures of ecosystem/receptor characteristics (EPA/630/R-95/002F). LOEs are evaluated based on data collected as described in the SAP (DOE/RL-2005-42). The analyses are also supplemented by literature information and historical data. Each of these LOEs is explained in more detail below.

6.3.1 Measures of Ecosystem/Receptor Characteristics.

Measures of ecosystem and receptor characteristics are measures that influence the behavior and location of entities selected as the assessment endpoint, the distribution of a stressor, and life-history characteristics of the assessment endpoint or its surrogate that may affect exposure or response to the stressor (EPA/630/R-95/002F). Measures of ecosystem/receptor characteristics include the following kinds of information:

- Field measures
  - Abundance
  - Diversity
  - Community structure
  - Gross morphology

- Reproduction observed in field
  - Reproductive rates
  - Juvenile recruitment
  - Gender ratios

- Abiotic data (pH, soil texture, etc.).

Additional information on the measures of ecosystem/receptor characteristics used to evaluate the potential for ecological risk for each assessment endpoint is provided in the risk characterization sections below.

6.3.1.1 Terrestrial Community Measures. Field biologists collected small mammals and invertebrates at terrestrial sites and assessed cover of plants, bare ground, litter, and cryptogams. This information was used to determine percent plant species richness and diversity. These data were in turn used to evaluate the investigation areas in terms of operational versus reference site comparability and to make inferences on the expected abundance and types of wildlife receptors. Because terrestrial invertebrate sample mass was limited, additional organisms had to be collected by hand, which obviated estimating relative abundance in an unbiased manner, and these results are not shown.

Plants

Line transects and modified Daubenmire plots (Daubenmire 1959) were used to estimate canopy cover of dominant plant species, bare ground, and cryptogam cover. Line transects were employed in areas that are dominated by shrubs (e.g., remediated native soil sites), whereas modified Daubenmire plots were used at all terrestrial site types. The following vegetation attributes were monitored: percent bare ground (rock and soil), presence of cryptogams, species richness (number of species), and species composition of canopy cover. The modified Daubenmire method used a 20-cm by 50-cm (8-in. by 20-in.) quadrant frame systematically placed along a tape on permanently located transects. The x and y dimensions of each investigation area were taken, and a total of 24 plots were evenly spaced and surveyed across each investigation area. For either method of recording vegetation cover type, the dominant plants were noted. This information was used in consideration of plant collection. Rare plants were also surveyed, and this information can be found in Appendix H (Section H-9).

Plant diversity was calculated from Daubenmire data using the Shannon diversity index (H), a metric commonly used to characterize species diversity in biological communities. Shannon's index accounts for both abundance and evenness of the species present. The proportion of species i relative to the total number of species (p_i) is calculated and then multiplied by the natural logarithm of this proportion ($\ln p_i$). The resulting product is summed across species, and multiplied by -1:

$$H = -\sum_{j=1}^{n} p_i \ln p_i$$

In contrast to summation by species relative proportion, however, all RCBRA floral community calculations were based on relative percent cover. In this investigation, visual estimates of cover were made. It is important to note that the same investigators collected these data to minimize observer bias. Plant cover surveys occurred between late March to late May, and data collection for investigation areas and reference sites occurred in approximately the same time period to ensure comparability of the information.

Mammals

Small mammal sampling was accomplished using live traps placed in an array in the center of the investigation area. Trapping was conducted between February and June, when animals were most active. Typically one or two trap lines each consisting of 10 Sherman live traps (8 cm [3 in.] wide by 9 cm [3.5 in.] high by 23 cm [9 in.] long) were placed in parallel with the edges of an array set up to accommodate the shape of the investigation area. Identical trapping methods were employed in similar habitats at reference locations. Traps were spaced systematically 10 m (32.8 ft) apart, and the number of trap lines varied according to the habitat being sampled, particularly along the riparian environment where the habitat is basically linear, parallel with the river. The grid location for the trap where the animal was captured was noted in the field logbook.

Trapping arrays were limited to one habitat type when possible. The animals were trapped over enough nights to obtain at least six mice from each investigation area. To the extent possible, the same species was sampled at all investigation areas. The number of trap-days required to get at least six animals per species was recorded to provide a relative measure of animal density/abundance. Other species were captured if insufficient numbers a single species of mice were obtained. Information on species, age, sex, and reproductive status (subadults/adults, and nonscrotal males/scrotal males and nonlactating/lactating females) body weights (± 2.0 g), general external condition (any gross deformities, hair loss, infections, lesions, etc.) was recorded on captured animals. Animals captured and released (nontarget animals) were marked so that the total number of new captures per trap-night could be used to represent relative abundance estimates measured and documented for each study site.

Kingbirds

Surveys were performed to identify eastern and western kingbird (*Tyrannus tyrannus* and *Tyrannus verticalis*, respectively) nests in trees in 5-km-long sections of onsite riparian areas along the 100 Area and the 300 Area shoreline. One reference location was upstream of the Hanford Site in the Vernita Bridge area. Exposure of insectivorous birds was measured by collecting juvenile kingbirds just prior to fledging for analysis of contaminants in their tissue. Hatching success (number of young hatched per nest) was planned as an estimate of kingbird reproductive success. Observations included the total number of eggs per clutch and the number of young successfully hatched per nest. Fledglings were also collected from the nest for tissue analyses. The crop was separated from the carcass and analyses were performed on both, the former providing information on contaminants in the diet and the latter providing information on site-specific exposure and dietary contaminant uptake into the birds.

6.3.1.2 Aquatic Community Measures. As a component of invertebrate biomonitoring and sampling in the aquatic environment, biologists studied the communities of organisms inhabiting artificial substrate. Rock baskets were placed in the continuously submerged, unconsolidated substrate for colonization by benthic macroinvertebrates. These devices provide a standardized way to measure bioaccumulation into benthic macroinvertebrates and also provide measures of effect. Rock baskets were colonized by aquatic invertebrates and provide measures of community structure through invertebrate diversity and abundance.

Rock baskets were anchored and partially embedded into near-shore sediments of the Hanford Reach, Columbia River during the fall of 2005 and collected for analysis in July 2006. Baskets, 16.5 cm in diameter and 28 cm long, were filled with 45- to 60-mm-diameter gravel. Six replicate rock baskets were placed as follows:

1. Ten stations bracketing plumes of chromium at the 100-K and 100-D Areas (one station was lost over the 6-month deployment, resulting in only nine stations retrieved).

2. Ten stations bracketing a groundwater plume of uranium at the 300 Area.

3. Seven stations representing reference conditions.

4. Rock baskets were not placed in the strontium plume because benthic macroinvertebrates had been previously collected in this area through a related sampling effort (DOE/RL-2006-26).

Six rock baskets were deployed at each station. When baskets were retrieved, benthic macroinvertebrates were washed from the gravel in three baskets (500 micron retention) and preserved in alcohol for analysis of the benthic invertebrate community. Each basket represents a separate replicate at each station. The remaining three baskets were used for tissue analysis for metals. Hand-picked crayfish were used to augment sample mass to reach the target biomass for benthic macroinvertebrate tissue in some aquatic stations.

Benthic macroinvertebrate samples were analyzed with the aid of a dissecting scope. A sorting efficacy of >95% was maintained. A minimum subsample of 500 organisms or the entire sample was sorted. Subsampling was accomplished with the Caton tray method. Most insects were identified to the genus or species level, with the exception of the Chironomidae (midges) identified to the family level. Oligochaeta worms were identified only to class, except leeches to family or genus. Because mollusks were of special concern, Deixus Consultants, Seattle, Washington, identified them to species.

6.3.2 Measures of Exposure

This aspect of the assessment provides information used in quantifying ecological exposure to contaminants in environmental media. The principal aspects of the exposure assessment are the measurement of exposure concentrations in each medium and the calculation of exposure to wildlife. The receptors and exposure pathways associated with terrestrial upland, riparian, and near-shore environments are described in the CSM (Section 2.0).

The project deployed dosimeters as quantitative measure of the total external radiation field at the upland and riparian investigation areas. The dosimeters provide a measure of external exposure to human and ecological receptors from gamma-emitting radionuclides. Section 4.0 provides a comparison of the dosimetry results for each site, for each environment, and for reference sites compared to waste sites or operational areas.

Ecological exposure analysis characterizes potential or actual contact or co-occurrence of COPCs with receptor species (EPA/630/R-95/002F). The ecological exposure analysis is performed by quantifying concentrations of chemicals and radionuclides in exposure media (e.g., soil, sediment, water, and biota) within the terrestrial upland, riparian, and near-shore aquatic zones of the River Corridor. Lower and middle trophic-level receptors were measured for COPC concentrations in tissues to provide input for modeling exposure to higher trophic levels. In the terrestrial environments (upland and riparian), exposure to the higher trophic levels was characterized by modeling efforts. For aquatic environs, exposure to lower and middle trophic levels is represented by concentrations in water or sediment. Higher trophic levels (e.g., great blue heron) are assessed by exposure modeling based on direct measures of COPCs in prey.

6.3.2.1 Assessment of Contaminant Uptake. In an ecological risk assessment, an important aspect of exposure involves determining whether plants and animals are taking up COPCs from environmental media including soil, sediment, and water. Data were evaluated for statistically increased tissue concentrations versus concentrations in abiotic media. These contaminant transfer factors are an empirical ratio of contaminants in soil to contaminants in biota, based on paired biotic and abiotic samples. For example, COPC concentrations in composite plant samples from terrestrial (upland or riparian) investigation areas are compared to soil COPC data to determine whether correlations exist. The distribution of COPCs in soil versus biological tissues (plants, terrestrial invertebrates, small mammals), COPCs in sediment versus benthic macroinvertebrates and clams, and COPCs in pore water versus benthic macroinvertebrates and clams are presented in Section 4.0 and Appendix F-5.

6.3.2.2 Ecological Exposure Assessment Modeling. This section describes the methods for estimating exposure concentrations to ecological receptors in the terrestrial upland, riparian, and near-shore aquatic environments through the sources and pathways described in Section 2.0. The CEM for the 100 Area and 300 Area Component of the RCBRA includes remediated waste sites located in upland areas and pathways associated with past releases. Potentially affected media from contaminated waste sites include surface soils, vadose zone soils, subsurface vapors, fugitive dust, groundwater, surface water from springs and seeps, pore water and sediment within the hyporheic zone, surface water of the Columbia River, and various terrestrial and aquatic biota. These media are described in Section 2.5.1 of the risk assessment report. Exposure routes to these media include the following:

- Inhalation of contaminated dust or volatilized COPCs
- Incidental or intentional ingestion of contaminated soil, sediment, groundwater, surface water, or biota
- Dermal contact with contaminated soil, sediment, biota, groundwater, or surface water
- Exposure of terrestrial and aquatic vertebrates, invertebrates, and plants to external radiation emitted by contaminated soil, sediment, or biota
- Uptake or absorption of soil-, sediment-, or water-bound COPCs.

While there is a potentially complete exposure pathway to ecological receptors via inhalation, published exposure pathway analyses indicate that inhalation is a minor exposure route for terrestrial receptors. For example, inhalation of particulates is < 0.001% of total exposure for the meadow vole (EPA 2005), the terrestrial mammalian herbivore identified in the WAC terrestrial ecological evaluation (see WAC 173-340-7490, "Terrestrial Ecological Evaluation Procedures"). In fact, incidental soil ingestion (e.g., through preening, fur cleaning) and dietary ingestion represent more than 99.8% of total vole exposure for common environmental contaminants and accounts for eating contaminated plants. The CEM explicitly accounts for bioaccumulation and trophic transfer (i.e., ingestion of contaminated plants and animals) of site contaminants.

A complete pathway exists for dermal contact from shallow soil, but the fur and feathers of wildlife serve as an effective barrier to soil exposure (EPA 2005). Consequently, dermal contact is a less important component of total exposure relative to direct ingestion pathways. Dermal contact or root uptake is, however, important to ecological receptors such as plants and soil invertebrates, considering their close association with soil. For wildlife, the inhalation and dermal exposure pathway's small contribution to total exposure justifies focusing on ingestion for exposure modeling.

Exposure modeling is based on site-specific abiotic COPC data and on COPCs detected in taxonomic representatives of lower and middle trophic-level species sampled for tissue analyses. An understanding of dietary exposure involves an assessment of secondary exposure through biological trophic-level linkages in the ecological food web, where functional groups are represented as general classes of organisms sharing common characteristics. For example, ecological systems are composed of many feeding relationships. Some organisms prey on plants (herbivores), plants and animals (omnivores), or just animals (carnivores). Within a particular trophic category, more specific feeding classes exist; e.g., herbivores are represented by granivores (seed-eating animals), folivores (stem- and leaf-eating animals), fungivores (fungi-eating animals), and nectivores (nectar-drinking animals). Given the nature of Hanford Site COPCs (primarily metals and radionuclides) and greater uptake in invertebrates relative to plants, risks to invertebrate-eating organisms (e.g., insectivores) are of particular interest.

While reptiles are an important component of arid environments like the Hanford Site, the general dearth of toxicity information for lizards and snakes limits the utility of exposure modeling to this group. Amphibians can be found at locations within the Hanford Site, but they too are limited with regard to information on toxicity based on food ingestion pathways. Consequently, reptiles and amphibians were not evaluated in the ecological exposure modeling component of this risk assessment. It is noted that amphibians are broadly protected by some abiotic media benchmarks for direct exposure (e.g., water quality protection levels). This project is directly assessing effects on amphibians from COPCs in pore water using the FETAX bioassay (see Section 6.3.3).

Calculation of Exposure

Adverse effects are inferred by the ratio of exposure to effect levels (toxicity reference values [TRVs]). The oral exposure model used for middle and upper trophic levels is from the *Wildlife Exposure Factors Handbook* (EPA/600/R-93/187a) and is provided in Equation 6-1:

$$E_{oral} = C_{soil} \cdot I_{soil} \cdot AUF_{soil} + C_{sed} \cdot I_{sed} \cdot AUF_{sed} + C_{water} \cdot I_{water} \cdot AUF_{water} \cdot (1/d_{water}) + C_{food} \cdot I_{food} \cdot AUF_{food}$$

Equation 6-1

where E_{oral} is the estimated oral daily dose for a COPC (mg/kg/day)

C_{soil} is the concentration of chemical constituent x in soil (mg/kg dry weight)

I_{soil} is the normalized daily soil ingestion rate (kg of soil / [kg of body weight • day], simplified to kg/kg/day in subsequent equations)

AUF_{soil} is the area use factor that represents the fraction of soil ingested from a contaminated area (this fraction is set to one)

C_{sed} is the concentration of chemical constituent x in sediment (mg/kg dry weight)

I_{sed} is the normalized daily sediment ingestion rate (kg of sediment / [kg of body weight • day], simplified to kg/kg/day in subsequent equations)

$AUF_{sediment}$ is the area use factor that represents the fraction of sediment ingested from a contaminated area (this fraction is set to one)

C_{water} is the concentration of chemical constituent x in water (mg/L)

I_{water} is the normalized daily water ingestion rate (kg of water / [kg of body weight • day], simplified to kg/kg/day in subsequent equations)

AUF_{water} is the fraction of water ingested from a contaminated area (this fraction is set to one)

d_{water} is the density of water (1 kg/L)

C_{food} is the concentration of COPC in food (mg/kg dry weight)

I_{food} is the normalized daily dietary ingestion rate (kg of food [dry weight] / [kg of body weight • day], simplified to kg/kg/day in subsequent equations)

AUF_{food} is the fraction of the diet derived from a contaminated area (this fraction is set to one).

Given an organism's normalized daily ingestion rate, this model provides an estimate of the oral exposure associated with a concentration of an inorganic or organic chemical in soil, sediment, food, and water. Soil and sediment ingestion are calculated as a fraction of dietary intake. An implicit assumption of this model is that the bioavailability of the COPC from the environmental media is comparable to the bioavailability of the contaminant in the toxicological experiment. Because little information currently exists on bioavailability conversions, a bioavailability term was not included in the general wildlife exposure model and bioavailability is considered to be 100%. This is an extremely protective approach to estimating ecological risk.

Considering the mobility of wildlife receptors, it is logical to proportion their exposure to a contaminated site relative to their use of that site. For example, in the course of daily foraging, the site may represent a small fraction of the total areas where the animal forages. In the exposure modeling exercise, it is assumed that an animal receives all of its exposure from the site. For all of the lower and most middle trophic-level representative receptors evaluated in the ecological exposure assessment, this is reasonable assumption. However, for other receptors, particularly the carnivores and aerial insectivores, this is an extremely protective assumption.

Equation 6-1 assumes that a single food type is ingested. Assessment endpoint-specific exposure modeling must be defined for herbivores, omnivores, insectivores, and carnivores. Exposure modeling is based on RCBRA site-specific abiotic COPC data and on COPCs detected in the taxonomic representatives of lower and middle trophic-level species sampled for tissue analyses: invertebrates (including clams and aquatic and terrestrial macroinvertebrates), fish, kingbirds, and small mammals. Exposure models for all assessment endpoints in upland, riparian and near-shore aquatic zones were developed to cover herbivorous, omnivorous, invertivorous, and carnivorous trophic categories (Tables 6-1a, 6-1b, and 6-1c).

Biological tissue data are reported as fresh weight. Because the *Wildlife Exposure Factors Handbook* (EPA/600/R-93/187a) presents most normalized food ingestion rates on a dry-weight basis, dietary constituents must undergo dry-to-wet weight conversions. Food ingestion rates are expressed as kilograms of food (wet weight) per kilogram of body weight (wet weight) per day (kg/kg-day). Dietary composition (e.g., proportion of diet consisting of various plant or animal materials), often measured by stomach-content analyses, is expressed as percentage of total intake. This convention facilitates comparison with contaminant concentrations in dietary items reported on a wet-weight basis. The equations listed in Tables 6-1a (upland), 6-1b (riparian), and 6-1c (near-shore) are representative of the code used to calculate exposure. In the actual code, a conversion factor (CF_{drywet}) is used to convert $Intake_{food}$ from a dry to wet weight basis.

Parameters required for calculations of the general wildlife exposure model, conversions, and other elements of the model are provided for wildlife assessment endpoints in Appendix H (Section H-1). It is important to note that exposure parameters provided generally represent conservative upper estimates of potential exposure. For example, water intake represents the total daily water intake requirement, and the receptors obtain much of that water in their diet, not from surface-water sources.

6.3.3 Measures of Effect

Measures of effect are measurable changes in an attribute of an assessment endpoint or its surrogate in response to a stressor to which it is exposed (EPA/630/R-95-002F). Measures of effect include the following kinds of information:

- Literature toxicity information
- Literature-based tissue effect levels
- Laboratory toxicity tests
- Field measures of survival, abundance, diversity, and gender ratio
- Histopathology measurements.

6.3.3.1 Literature Toxicity Information. Most of the published toxicological data represent the results of tests with single chemicals. Toxicity information such as this was compiled for RCBRA receptors and may be expressed as concentrations in media (i.e., water, soil, or sediment) or dietary doses associated with the presence or absence of effects. Media-based effect levels are used to evaluate exposures for most aquatic-, sediment-, or soil-associated biota (i.e., fish, benthic macroinvertebrates, plants, and terrestrial invertebrates). Dietary doses are generally used to evaluate modeled exposure estimates for birds and mammals. The collection of dose thresholds or TRVs for wildlife were extensively reviewed and selected based on defined quality criteria (e.g., LANL 2005).

Lower trophic-level plants and invertebrates receive exposure to COPCs primarily through the abiotic medium in which they live. For example, terrestrial plants and invertebrates are primarily exposed through soil, while exposure received by freshwater sediment-associated biota is primarily through sediment. For all of these receptors, exposure occurs as a consequence of living in a contaminated medium (i.e., receptors are directly exposed to COPCs). Although other exposure pathways (e.g., dietary exposure for aquatic invertebrates, or foliar uptake by plants) may contribute to total exposure for each receptor, exposure through the contaminated medium predominates. Consequently, estimates of exposure are measured as a function of the concentration of contaminants in the affected medium.

Considering radionuclides, whether they are plants or animals, aquatic or terrestrial, biota receive radiation exposure through a combination of both internal and external pathways. Internal exposure is a function of radiation emitted from radionuclide concentrations retained in tissues. External exposure is due to radiation from radionuclides in soil, sediment, and water with which biota come into contact. Models for estimating internal and external radiation exposure have been developed and integrated into the biota concentration guides (BCGs) (ANL 2006). The BCGs represent the radionuclide concentration in soil, sediment, or water (in pCi/g or pCi/L) that correspond to a conservatively calculated radiation dose equal to the radiation effect threshold appropriate for the given receptor (0.1 rad/day or 1 rad/day, depending on the receptor group). Radionuclides were not evaluated through exposure modeling; concentrations in abiotic media were compared directly to BCGs (Appendix H, Section H-2). Radionuclides in sediment, water, and soil are compared to BCGs; the resulting ratios are presented as sums of fractions (SOFs) for all sites and environments. SOFs greater than unity may indicate a potential for ecological effects from radionuclides.

As noted previously, information is limited for reptile and amphibian TRVs and intake; therefore, exposure modeling for this group was not performed. Ecological screening levels for lower trophic levels are presented in Appendix H, Section H-2, and TRVs for upper trophic-level wildlife are presented in Appendix H, Section H-3. These abiotic media benchmarks and TRVs were used to generate HQs, the ratio of exposure to effect level.

Adverse effects for nonradionuclide COPCs to wildlife are evaluated using the ecological exposure assessment modeling approach discussed in Section 6.3.2.2. Adverse effects are inferred by the ratio of modeled exposure to effects levels, which are TRVs derived from the scientific literature. Modeled effects based on analyte-specific ratios are HQs. Receptor-specific HQs are summed into an HI for each receptor at each terrestrial investigation area and aquatic study area. It is important to recognize that while this is a baseline risk assessment, it relies primarily on no-effect level benchmarks and TRVs, which are normally used in an ecological screening-level assessment. Exceedance of no-effect levels does not necessarily indicate a risk. Use of no-effect levels is another contribution to the conservatism inherent in this risk assessment.

6.3.3.2 Literature-Based Tissue Effect Levels. Tissue-based exposures are empirically measured concentrations of COPCs in tissues of exposed animals. These tissues generally represent target organs for toxic effects from the COPC. For the RCBRA, tissues include whole body, muscle, soft tissues, and liver/kidney, depending on the receptor.

Tissue-based exposures consist of concentrations of COPCs in tissues of receptor species that are the focus of contaminant toxicity. They can then be compared to available literature/information for concentrations of contaminants in specific tissues that are associated with adverse effects. This provides another measure of the potential nature and magnitude of effects that receptors may experience at the site. Tissue-based exposure data represent the accumulation and retention of contaminants in the tissues of resident biota. Tissue-based exposure occurs as a result of media-based or dietary exposure and provides another measure of contaminant exposure at the site. Suter et al. (2000) state that use of tissue-based exposure/effect estimates has the following advantages: integrate all exposure pathways through which the individual may have been exposed; average exposure over both time and space; may indicate site-specific contaminant bioavailability (if field-collected data are used); and eliminate exposure model error and parameter uncertainty.

Limitations to the use of tissue-based exposure estimates in risk assessment include the availability of toxicity data with which to interpret body burdens (i.e., body burden effects levels are lacking for most chemicals) and the effects of metabolism and exposure duration. Contaminants that are ingested or otherwise taken up by biota are not always retained in the same form in which they occur in the environment.

In addition to existing data from the 100-B/C Pilot and 100-NR-2 investigations (DOE/RL-2005-40 and DOE/RL-2006-26, respectively), biota tissue samples collected for the RCBRA included near-shore, riparian, and upland zones and corresponding reference sites in the River Corridor, representing a variety of aquatic biota (i.e., fish, mollusks, and arthropods) and terrestrial biota (i.e., small mammals, terrestrial invertebrates, kingbirds, and plants). However, tissue-based toxicity data with which to evaluate these data were available only for aquatic arthropods (whole-body), clams (soft tissue), fish (liver and whole body), and small mammals (liver).

Tissue-based exposures for mammals consist of measured concentrations of contaminants in target organs (e.g., liver). Literature-derived concentrations of barium, cadmium, chromium, lead, manganese, mercury, nickel, and selenium in liver that have been associated with effects in field or laboratory animals were used to evaluate these tissue-based exposure data.

Tissue-based benchmarks for aquatic organisms (i.e., fish and water-column invertebrates) were developed from a database of tissue residues and associated effects for aquatic organisms compiled and presented in Jarvinen and Ankley (1999). Fish and water-column invertebrate benchmarks were chosen using the following selection criteria:

- Studies with the longest duration were chosen over shorter duration studies.
- For fish, studies involving salmonids were selected if available:
  - If more than one salmonid was available, those species that were most representative of fish species found at the Hanford Site were selected (e.g., rainbow trout).
  - If a salmonid was not available, a freshwater species that was most representative of fish species found at the Hanford Site was selected (e.g., bluegill).
- For aquatic invertebrates, species that have been collected at the Hanford Site, or those most representative of species collected at the Hanford Site, were selected.

6.3.3.3 Laboratory Toxicity Tests. The RCBRA incorporates toxicity bioassays as one line of multiple LOEs. Ecology (1992a) reviewed toxicity testing methods included in this risk assessment and documented that these tests provide useful data on effects of contaminants on living organisms. Along with histopathology, toxicity bioassays were selected as a high-weighted LOE in the risk assessment for their ability to provide site-specific information and ecologically relevant effects data. In addition, while studies reported in the literature usually evaluated just one contaminant at a time, these bioassays offer site-specific information on adverse effects of contaminant mixtures and on contaminant bioavailability for Hanford Site aquatic media.

Test organisms with significant responses to known concentrations of contaminants can indicate the likelihood of biological impacts in a contaminated environment. Bioassays, one of the risk assessment's highest weighted LOE, evaluate the actual site media and offer a reality check on published toxicity values. For each terrestrial location, soils were submitted for two bioassays each, one for plants (Sandberg's bluegrass, *Poa secunda*) and one for animals (nematodes, *Caenorhabditis elegans*). For each aquatic station, sediment was bioassayed with a plant (pakchoi, *Brassica chinensis*) and the freshwater amphipod *Hyalella azteca*. Pore water from each aquatic station was also bioassayed with frog embryos (*Xenopus laevis*) and the water flea *Ceriodaphnia dubia*. Results from these tests inform decisions about permissible contaminant concentrations and exposure limits to sensitive organisms.

Because of irregularities in the terrestrial phytotoxicity testing, all results from the laboratory in question (five of the six bioassays used in this assessment) were subject to formal data validation that went beyond the QA measures specified in the SAP (DOE/RL-2005-42). Based on this review, the terrestrial phytotoxicity tests were invalidated. In addition, some of the sediment phytotoxicity test results were invalidated, but overall the pakchoi test results are considered adequate with suspect results removed. Results of the remaining bioassays were judged valid.

6.3.3.4 Survival in the Field. In situ survival of clams was assessed at aquatic stations. Six replicate tubes consisting of 25 clams per tube were deployed at the chromium and uranium plumes at RCBRA near-shore aquatic stations. Clam tubes were not deployed in the strontium plume because bivalve data were collected there through previous complementary investigations (DOE/RL-2005-22). Organisms were collected after prolonged exposure, and the number alive was counted. A subset of clams were evaluated for histopathological effects.

6.3.3.5 Histopathology. Site-specific histopathology data were collected on aquatic receptors in the risk assessment. Tissue samples from receptors residing at the site were analyzed for evidence of adverse effects from COPECs. This LOE evaluated site-specific measures of effects, incorporated site-specific exposure and bioavailability, and considered potential effects from chemical mixtures. Weight for this LOE was considered high.

Histopathology was assessed for operational area and reference site clam samples. Analyses included inspection and documentation of clinical condition, connective tissues, mantle, gills, kidney, adductor muscle, foot, nerves/ganglia, digestive system, reproductive system, and gender. For some tissues (i.e., gills and digestive and reproductive systems), multiple attributes were assessed. Tissues were scored based on the presence, condition, and/or severity of the histopathological observation. Numeric measurements, such as shell length and reproductive abnormalities (number of degenerate follicles, follicle cysts, and necrotic reproductive ducts), were also documented.

Histopathology was also assessed for operational area and reference site fish samples. Analyses included inspection and documentation of conditions in integument (skin, epithelium, scales), connective tissues, gills, blood and blood vessels, spleen, hematopoeitic tissue, excretory system, skeletal muscle, cartilage and bone, nervous system, digestive system, liver, and reproductive system. Multiple measurements were collected for specific key organ components. Contingency analyses were performed to determine if the number of occurrences of a particular histopathological score differed significantly from the number that was expected if the scores are independent of location (operational area versus reference area).

6.4 RISK CHARACTERIZATION: WEIGHT OF EVIDENCE

This ecological risk assessment is focused on characterizing risks to assessment endpoints (ecological receptors) using a WOE approach to determine exposure and potential effects of hazardous substances (Hull and Swanson 2006, Fairbrother 2003, Menzie et al. 1996). The assessment endpoints are focused on middle trophic-level receptors (e.g., invertebrates and small mammals) and are evaluated based on terrestrial and near-shore aquatic environmental site types. All chemical and biological data related to the site, including results of chemical analyses, toxicity testing, and field studies, are used to characterize risk. Several other parameters are evaluated to characterize the ecological significance of the risk, such as relative population size and habitat suitability. The WOE approach relates measures of effects to an assessment endpoint using a balance of literature, field, and laboratory data to assess the potential for risk to the environment. The WOE evaluation provides an explicit link between risk characterization and the assessment endpoints.

LOEs are weighted using specific data usability criteria based on the following:

- Whether the measurement is an integrated versus single COPC analysis
- Site-specificity
- Standardization
- Replication/repeatability of the measurement
- Variability
- Relevance to management goals.

LOEs are then evaluated with regard to the magnitude of effect and degree of corroboration among other LOEs for each assessment endpoint.

Types of literature toxicity information, field measures, laboratory toxicity testing and bioassay descriptions are presented in the SAP (DOE/RL-2005-42). In addition, histopathology measurements for bivalves and fish were included as a LOE in the SAP (DOE/RL-2005-42) but were not weighted. To address this oversight, the participants in the risk assessment process (October 2006 Regulator/Trustee Workshop, Appendix D) were asked to rank histopathology.

Workshop attendees put a high weight on this LOE noting its importance from an injury perspective and that it met the weighting criteria listed above (e.g., site specificity) fairly well. Comparisons to reference/background concentrations and biological condition in the field are evaluated in the risk analysis but not weighted as LOEs.

In addition to these LOEs, considerations are made as to whether a given LOE was fully or partially captured. For example, the intended sample mass may not have always been achieved because of factors outside the control of the sampling crew. Consider that in the first attempt at surveying kingbird breeding success and collecting nestlings for COPC analyses, not all targeted avian mass was collected because of predation on the young birds by crows and ravens. Failure to achieve the intended goals for any LOE would detract from the utility of that measure. In addition, confounding factors may affect any LOE (e.g., non-COPC effects such as substrate texture on toxicity test results). For this reason, multiple LOEs were sought to characterize each assessment endpoint as both a contingent measure and to provide different perspectives on the status of the endpoints. The LOEs are combined into a weight of evidence for assessment endpoints on a trophic-level basis. In the sections that follow, risks to upland, riparian, and near-shore receptors are discussed.

6.4.1 Risks to Upland Receptors

Risks to terrestrial upland receptors are characterized according to assessment endpoints developed for this exposure zone. Assessment endpoints include lower trophic-level producers and invertebrates and middle and upper trophic-level birds and mammals. Risks to upland assessment endpoints are based on multiple LOEs as described below.

6.4.1.1 Upland Plants

Literature values for survival, growth, or reproduction

One measure of risk to plants is based on comparisons of COPC concentrations in abiotic media to phytotoxicity screening benchmarks. Radionuclide SOF, the sum of ratios of radionuclide activities in soil to BCGs, for upland plants are considerably less than one (Figures 6-1a and 6-1b). These results suggest that total radionuclide doses to plants are much less than the dose limits proposed in Biota Dose Assessment Committee (BDAC) guidance (DOE-STD-1153-2002). Considering risk from nonradionuclides, Figures 6-1c and 6-1d show plant HQs summed as HIs based on comparing COPC concentrations in soil to screening benchmarks for plants (Appendix H, Section H-2) at a site and summing the HQs for that site. As shown in Figures 6-1c and 6-1d, plant HIs are uniformly elevated above one. Considering the average HQs for individual COPCs across all sites (Appendix H, Section H-4, plants) and site-specific HQs (Appendix H, Section H-5), it is clear that vanadium in soil is primarily contributing to elevated HIs for plants. Vanadium is a naturally occurring element in soil; concentrations at remediated waste sites are consistent with background and reference concentrations and the screening benchmark is considerably lower than Hanford Site background concentrations, hence the elevated HI values. There are no statistically significant differences between plant HIs at remediated waste sites and associated reference sites (Student's t test, α=0.05).

Diversity and abundance from plant surveys

Plant diversity, richness and total cover at Hanford Site terrestrial upland sites are shown in Figures 6-2a, 6-2b, and 6-2c. There are no statistically significant differences between these community metrics among backfilled, native soil and associated reference sites (Tukey- Kramer HSD [honestly significant difference] test, α=0.05). Additional information on the upland terrestrial plant community is available in Appendix H (Section H-9) such as the percentages of litter, rock, bare ground, and cryptogamic crust. Plant diversity and abundance measures correlated with 8 detected soil or plant tissue COPC concentrations out of 287 possible models, which is less than 3% frequency and consistent with the frequency expected based on the 5% significance level tested (Table H-7-7). Two of these eight COPCs are possible confounding factors (pH and fraction very fine sand), and three other COPCs were only detected two or three times.

Considering rare plants, an inventory was recently performed to address the potential impact of past management of the Hanford Site on the flora and fauna of the site and to assess whether the remediation activities have achieved the objective of restoring the landscape to pre-Hanford Site conditions. Representative plots were established within the 20 upland backfill and native soil sites and sampled intensively for this study; reference sites were not included in the inventory. No rare plants were observed in the upland sites during the 2006 survey.

Measured tissue concentrations

The lack of plant contaminant uptake indicates minimal COPC exposure. Some COPCs are detected in plants, but tissue concentrations do not correlate with abiotic media concentrations (Section 4.0, Table 4-21).

Survival, growth from toxicity testing

The RCBRA is built on multiple LOEs. Among them are bioassays to evaluate the potential for effects on plant germination and growth from soil contaminants. The ASTM bioassay test standard for plants was written for a standardized species such as ryegrass. However, in response to trustee request for use of a more ecologically relevant plant in the bioassays, Sandberg's bluegrass (*Poa secunda*) was substituted per the SAP (DOE/RL=2005-42). Unfortunately, there were data recording issues, such as not documenting a change in seed lots during testing and other methodological problems with the plant bioassay. The project solicited an independent review of all of the bioassays with the exception of FETAX by Dr. Larry Kapustka (Golder, Inc., Alberta, Canada). In his review, Dr. Kapustka expressed concerns about use of the results in the risk assessment because of testing irregularities, and his recommendation was to invalidate these results. The results of the Sandberg's bluegrass bioassays are available from the GiSdT database (http://rcbra100-300.neptuneinc.org/rcbra100-300/home/index.xml), but the results from these bioassays are not incorporated as one of the LOEs for evaluating ecological risk from COPCs to terrestrial plants.

Upland Terrestrial Plant Risk Summary

No LOEs suggest that COPCs are adversely affecting terrestrial plants in upland soils. The general lack of plant contaminant uptake indicates minimal COPC exposure. Some COPCs are detected in plants, but tissue concentrations do not differ between upland remediated waste sites and reference sites and generally do not correlate with abiotic media concentrations. Another measure of risks to upland plants is based on comparisons of soil concentrations to screening benchmarks. Hazard indices for plants based on these benchmarks are greater than 1 (most fall between 25 and 35) for all sites but are not different between remediated waste and reference sites, indicating that potential risks to plants are based largely on concentrations of naturally occurring elements in soil and not due to COPCs. The weight attributed to this LOE is low. A medium-weighted LOE, field measures, shows no difference in plant diversity, richness, and cover at remediated waste sites compared to reference sites. Plant toxicity testing was performed, but the results are compromised by issues with laboratory test methodology and are not being used as a basis for conclusions on plant effects. The other LOEs for plants are used to draw inferences regarding the potential for ecological risks to plants from COPCs at upland sites.

6.4.1.2 Upland Terrestrial Invertebrates

Literature values for survival, growth, or reproduction

Soil invertebrate HQs are based on comparing COPC concentrations in soil to screening benchmarks for terrestrial invertebrates (Appendix H, Section H-2). Hazard indices for soil invertebrates (Figures 6-3a and 6-3b) are summed HQs and are elevated above one, indicating the potential for risk. The main contributors to elevated soil invertebrate HIs are detected PAHs (Appendix H, Section H-4). The mean soil invertebrate HI at upland reference locations is half that of upland waste sites (2.4 versus 4.9, respectively), and this difference is statistically significant (Student's t test, $\alpha=0.05$, $p=0.0018$, assuming unequal variances). The weight associated with this LOE is low.

Diversity and abundance from pitfall traps

For terrestrial invertebrates, hand-picking organisms was necessary to gain sufficient mass for analytical COPC measurements. While it facilitated the laboratory analyses, this collection approach disabled field data-based estimates of relative abundance as a LOE.

Measured tissue concentrations

In an evaluation of statistically significant regressions and positive relationships for soil to biotic tissue concentrations, only 2% of the correlations qualified ($\alpha=0.05$) (Section 4.0, Table 4-21). In other words, the frequency of statistically significant correlations observed between contaminants in soil invertebrates and soil across upland sites falls in the range of that expected based on chance alone.

Survival from toxicity testing

ASTM E2172-01, *Standard Guide for Conducting Laboratory Soil Toxicity Tests with the Nematode 'Caenorhabditis elegans,'* is a standard invertebrate toxicity test for soils. This test is preferable to common earthworm bioassays because earthworms require a mesic environment and their distribution is limited in arid soil characteristics of the Hanford Site (Markwiese et al. 2001). Because bioassays must provide ecologically relevant information, the ubiquitous nematode is a suitable test organism for this assessment. Soil material was collected for five laboratory replicates. The soil samples were checked for the presence/absence of organic material, and the samples were sieved using screening intervals to determine clay and silt fractions. Soil was hydrated to a standard level and allowed to equilibrate for 7 days. Soil samples submitted for toxicity testing were also analyzed for geochemical parameters (e.g., pH, organic matter, particle size) to help interpret the results of the toxicity tests. This test measures mortality only and was run for 24 hours so that food did not need to be supplied. Figure 6-4 shows the results of nematode survival. Although survival may be a less sensitive endpoint than some sublethal effects, there are no statistically significant differences in nematode survival among backfilled native soil and associated terrestrial upland reference sites (Tukey- Kramer HSD test, α=0.05). Nematode survival correlated with 2 detected soil or invertebrate tissue COPC concentrations out of 233 possible models, which is less than 1% frequency and consistent with the frequency expected based on the 5% significance level tested (Table H-7-8). The weight associated with this LOE is high.

Upland Terrestrial Invertebrate Risk Summary

The overall weight of evidence indicates that COPCs do not adversely impact terrestrial invertebrates. The highest weighted LOE for upland sites, toxicity bioassays of nematode survival, are not significantly different between remediated waste sites and reference sites. Some COPCs are detected in invertebrates, but concentrations of COPCs in invertebrates at remediated waste sites generally do not correlate with abiotic media concentrations. Hand-picking invertebrates was necessary to gain sufficient mass for analytical COPC measurements. While this practice facilitated laboratory analyses, the collection approach precluded using estimates of relative abundance as a LOE. Lastly, while HIs for terrestrial invertebrates are significantly higher at remediated waste sites, mainly due to detection of PAHs, the weight attributed to this conclusion is low.

6.4.1.3 Upland Middle Trophic-Level Species

Literature values for survival, growth, or reproduction compared to modeled exposure

One measure of radionuclide risk to wildlife is assessed by the SOF (i.e., the sum of ratios of radionuclide activities in soil to BCGs). The SOFs for upland wildlife in remediated waste sites and reference sites are considerably less than one (Figures 6-5a and 6-5b). These results suggest that total radionuclide doses to upland wildlife are much less than the dose limits proposed in BDAC guidance (DOE-STD-1153-2002).

Mourning dove HQs are based on comparing estimated ingested dose from soil and diet (soil ingestion and 100% plant diet; Appendix H, Section H-1) to COPC-specific TRVs for birds (Appendix H, Section H-3). Hazard indices for mourning doves (Figures 6-6a and 6-6b) are summed HQs and are elevated above one but are not significantly different between upland remediated waste sites and reference sites (Student's t test, α=0.05). The main contributor to elevated HIs are vanadium, endrin aldehyde, and di-n-butylphthalate (Appendix H, Section H-4, mourning dove).

Pocket mouse HQs are based on comparing COPC exposure from soil and diet (soil ingestion and 100% plant diet; Appendix H, Section H-1) to COPC-specific TRVs for mammals (Appendix H, Section H-3). Hazard indices for pocket mice (Figures 6-7a and 6-7b) are summed HQs and are elevated above one but are not significantly different between upland remediated waste sites and reference sites (Student's t test, α=0.05). The main contributors to elevated HIs are thallium and nondetected PCBs reported at half their detection limits (Appendix H, Section H-4, pocket mouse).

Meadowlark HQs are based on comparing COPC exposure from soil and diet (soil ingestion and 37% plant and 63% terrestrial invertebrate diet; Appendix H, Section H-1) to COPC-specific TRVs for birds (Appendix H, Section H-3). Hazard indices for meadowlarks (Figures 6-8a and 6-8b) are summed HQs and are elevated above one but are not significantly different between upland remediated waste sites and reference sites (Student's t test, α=0.05). Vanadium and di-n-butylphthalate are the main contributors to elevated HIs for meadowlarks (Appendix H, Figure H-4, meadowlark).

Deer mouse HQs are based on comparing COPC exposure from soil and diet (soil ingestion and 50% plant and 50% terrestrial invertebrate diet; Section H-1) to COPC-specific TRVs for mammals (Appendix H, Section H-3). Hazard indices for deer mice (Figures 6-9a and 6-9b) are summed HQs and are elevated above one but are not significantly different between upland remediated waste sites and reference sites (Student's t test, α=0.05). The main contributors to elevated HIs are thallium and nondetected PCBs reported at half their detection limits (Appendix H, Section H-4, deer mouse)

Killdeer HQs are based on comparing COPC exposure from soil and diet (soil ingestion and 100% terrestrial invertebrate diet; Section H-1) to COPC-specific TRVs for birds (Appendix H, Section H-3). Hazard indices for killdeer (Figures 6-10a and 6-10b) are summed HQs and are elevated above one but are not significantly different between upland remediated waste sites and reference sites (Student's t test, α=0.05). Vanadium is the main contributor to elevated HIs for killdeer (Appendix H, Section H-4, killdeer), but vanadium concentrations are consistent with background and reference concentrations.

Grasshopper mouse HQs are based on comparing COPC exposure from soil and diet (soil ingestion and 100% terrestrial invertebrate diet; Section H-1) to COPC-specific TRVs for mammals (Appendix H, Section H-3). Hazard indices for grasshopper mice (Figures 6-11a and 6-11b) are summed HQs and are elevated above one but are not significantly different between upland remediated waste sites and reference sites (Student's t test, α=0.05). The main contributors to elevated HIs are selenium and thallium (Appendix H, Section H-4, grasshopper mouse); the average HQs for both are slightly higher than one. Selenium is not elevated in soil based on comparisons to background and reference site concentrations, but thallium can be associated with Hanford Site operations (Section 4.0).

Measured tissue concentrations

In an evaluation of statistically significant regressions and positive relationships for soil to biotic tissue concentrations, only 2% of the correlations qualified (α=0.05) (Section 4.0, Table 4-21). Cadmium, chromium, and tin in soil were significantly correlated to levels in small mammal tissue. However, the frequency of statistically significant correlations observed between contaminants in mammals and soil across upland sites fall in the range of that expected based on chance alone.

Literature values for survival, growth, or reproduction compared to measured exposure

COPCs in small mammal livers are compared to the threshold for tissue effects based on literature data. Mammalian liver tissue effects levels are found in Appendix H, Section H-6; in these figures, operational refers to riparian soils, reference refers to samples from both riparian and upland reference sites, as applicable, and waste sites are upland soil sites. As shown in Appendix H, Figures H-6-1-1 through H-6-1-4, only lead in mammal liver tissue from a reference site exceeded its tissue no-effect level. Mean small mammal tissue (liver) contaminant concentrations at upland waste sites are not greater than at reference sites and do not increase along an increasing contamination gradient (Section 4.0). The weight of this LOE is medium.

Field studies: Balanced gender ratios, juvenile recruitment, relative abundance, gross morphology

Over 300 small mammals were captured in this sampling effort. Deer mice and Great Basin pocket mice represented the majority of small mammals present in the 100 Area and 300 Area terrestrial investigation areas (53% and 42%, respectively; Table 6-2); additional species collected included a mountain vole, a bushy-tailed woodrat, a house mouse and several western harvest mice. Observations of gross morphological anomalies in captured animals were extremely infrequent. Of the 300 plus animals captured, 3 expired in the trap, 1 had an injured foot, and 1 was lethargic; the remaining animals were all essentially normal.

Summary results of field measures are shown in Figures 6-12a, 6-12b, and 6-12c. Additional information is available in Appendix H, Section H-9, showing the total males and females per terrestrial site (Figures H-9-1-5 and H-9-1-6), and the proportion of reproductively active males, represented as the proportion of scrotal males to total males per site, and the proportion of reproductively active females, represented as the proportion of lactating or pregnant females to total females per site (Figures H-9-1-7 and H-9-1-8). On average, more males than females were collected across all sites. But the total females and total males did not differ significantly among the sites. And while gender ratios deviated from equality, with more males than females captured, the ratio did not differ significantly among investigation areas (Tukey- Kramer HSD test, α=0.05) (Figure 6-12a).

Comparison of small mammal population measures (female or male reproductive frequency, relative abundance, or gender ratios) to small mammal COPCs identified a total of 12 COPCs in small mammal tissues (Table H-7-9). Two of these 12 COPCs are organic chemicals (Aroclor-1254 and Aroclor-1260) that were only detected once in small mammal tissue. The other COPCs are inorganic chemicals that are commonly detected in mammalian tissues.

The proportion of reproductively active males was similar among sites (Figure H-9-1-8). Reproductive output is expected to affect relative abundance of small mammals and total numbers of mammals. Mammal relative abundance (number collected divided by trap nights) and total mammals trapped per site were fairly evenly distributed across upland terrestrial sites (Figures 6-12b and 6-12c). The total number of mammals across all the sites did not differ significantly among site types, and relative abundance was significantly higher at native soil reference sites relative to other site types in the upland environment (Tukey- Kramer HSD test, $\alpha=0.05$, $p<0.05$). Of all upland sites, native soil reference sites best represent undisturbed, native shrub-steppe habitat; their greater relative abundance of small mammals is likely explained by relationships between small mammals and ecological characteristics of the plant community.

Upland Middle Trophic-Level Risk Summary

There is no indication of risk to birds from COPC concentrations. Exposure modeling for herbivorous, omnivorous, and invertivorous birds was performed, and exposure to invertebrates in the diet was of greatest concern considering the propensity for heavy metals and radionuclides to be taken up into terrestrial invertebrates. As with risks to avian herbivores and omnivores, risks to birds consuming terrestrial invertebrates were comparable between reference areas and remediated waste sites.

Overall, risks to small mammals from COPCs, a focal taxon of this investigation, are not indicated. Small mammal relative abundance, total numbers, and gender ratios were comparable in remediated backfill waste sites and borrow-pit reference site soils. Small mammal relative abundance was significantly higher at native soil reference sites relative to native soil remediated waste sites, which may be explained by characteristics of the plant community. Indications of reproductive differences were not apparent for small mammals inhabiting remediated waste sites relative to reference locations. Gross morphological anomalies were not evident in field-collected animals, and there was limited evidence of contaminant uptake. Significant positive correlations of concentrations of COPCs in soil versus small mammal tissue occurred at a frequency indistinguishable from chance alone, and COPCs in small mammal tissue were all below levels of concern in upland remediated waste sites. Hazard indices for small mammals occupying all trophic levels were above one at all sites and not statistically significantly different between remediated waste sites and reference sites.

6.4.1.4 Upland Upper Trophic-Level Species

Literature values for survival, growth, or reproduction compared to modeled exposure

Considering their mobility, badgers constitute the mammalian component of RCBRA multi-media receptors that can obtain surface water from the river for drinking in the course of foraging over upland sites. Badger HQs are based on comparing COPC exposure from soil and diet (soil and surface water ingestion and 100% small mammal diet; Appendix H, Section H-1) to COPC-specific TRVs for mammals (Appendix H, Section H-3). Hazard indices for badgers drinking river water and consuming soil and small mammals (Figures 6-13a and 6-13b) are summed HQs and are elevated above one but are not significantly different between upland remediated waste sites and reference sites (Student's t test, α=0.05). Because exposure to COPCs in surface water was negligible, HI results for aquatic sites were not included in the plots. The main contributor to elevated HIs is thallium (Appendix H, Section H-4, badger).

Red-tailed hawks were modeled as higher trophic levels exposed to multiple media, gathering prey from upland terrestrial sites (small mammals), and in the course of foraging in upland areas (receiving exposure to soil in the process), they could theoretically obtain surface water from the river for drinking. Hawk HQs are based on comparing COPC exposure from soil and diet (soil and surface water ingestion and 100% small mammal diet in upland area; Appendix H, Section H-1) to COPC-specific TRVs for birds (Appendix H, Section H-3). Hazard indices for hawks drinking river water and consuming soil and small mammals are presented in Figures 6-14a and 6-14b. Because exposure to COPCs in surface water was negligible, HI results for aquatic sites were not included in the plots. Hazard indices for red-tailed hawks consuming soil, surface water, and small mammals and birds are below one on average, suggesting low potential for risk. In addition, HIs are not statistically significantly different when comparing the upland waste and reference sites (Student's t test, α=0.05).

Upland Upper Trophic-Level Risk Summary

Risks to upper trophic-level birds are negligible on the basis of modeled dietary exposure. Through modeling, red-tailed hawks were exposed to multiple media, obtaining soil in their diet, ingesting small mammals and kingbirds, and drinking water from the river. Hazard indices were low and not significantly different among all locations and risks would be further reduced when considering a realistic home range and area use factor for these receptors.

Risks to upper trophic-level mammals are negligible on the basis of modeled dietary exposure. Badgers were exposed to multiple media through ecological exposure models, obtaining soil in their diet, ingesting small mammals, and drinking water from the river. Risks to upper trophic-level mammals are indicated by elevated (HI of about 10) HIs on the basis of modeled dietary exposure from individual sites. However, HIs are similar between remediated waste and reference sites, and risks would be further reduced when considering a realistic home range and area use factor for these receptors.

6.4.2 Risks to Riparian Receptors

Risks to terrestrial riparian receptors are characterized according to assessment endpoints developed for this exposure zone. Assessment endpoints include lower trophic-level producers and invertebrates and middle and upper trophic-level birds and mammals. Risks to riparian assessment endpoints are based on multiple LOEs as described below.

6.4.2.1 Riparian Plants

Literature values for survival, growth, or reproduction

One measure of risks to plants is based on the radionuclide SOF. This is the sum of ratios of radionuclide activities in soil to BCGs and, for riparian plants, the SOFs are considerably less than one (Figures 6-15a and 6-15b). These results suggest that total radionuclide doses to plants are much less than the dose limits proposed in BDAC guidance (DOE-STD-1153-2002).

Considering risk from nonradionuclides, Figures 6-15c and 6-15d show plant HIs based on comparing COPC concentrations in riparian soil to screening benchmarks for plants (Appendix H, Section H-2) at a site and summing the HQs for that site. As shown in Figures 6-1c and 6-1d, plant HIs are uniformly elevated above one. Considering the average HQs for individual COPCs across all sites (Appendix H, Section H-4, plants) and site-specific HQs (Appendix H, Section H-5), and as with upland sites, it is clear that vanadium in soil is primarily contributing to elevated HIs for plants in the riparian zone. There are no statistically significant differences between plant HIs at riparian operational sites and associated reference sites (Student's t test, α=0.05).

Diversity and abundance from plant surveys

Plant diversity, richness, and total cover at Hanford Site terrestrial riparian sites are shown in Figures 6-16a, 6-16b, and 6-16c. Relative to the upland zone, plant diversity was higher in riparian soils; conversely, riparian soils were higher in heavy metal concentrations relative to upland soils (Section 4.0). Within the riparian zone there are no statistically significant differences between plant community metrics between operational and associated reference sites (Student's t test, α=0.05). Additional information on the riparian plant community is available in Appendix H (Section H-9) such as the percentages of litter, rock, bare ground, and cryptogamic crust. Plant diversity and abundance measures correlated with 8 detected soil or plant tissue COPC concentrations out of 287 possible models, which is less than 3% frequency and consistent with the frequency expected based on the 5% significance level tested (Table H-7-7). Two of these eight COPCs are possible confounding factors (pH and fraction very fine sand), and three other COPCs were detected only two or three times.

An inventory of rare plants was performed in the 10 riparian operational sites; reference sites were not included in the inventory. In the riparian zone, rare plant species were found at sites 7, 8, and 9 (*Rorippa columbiae*) in the mid- to lower cobble riparian profile receiving surge from river flow; this species is also known to occur at riparian site 10 but was not observed in the survey. Riparian site 9 also had *Lipocarpha aristulata* occurring in fine-grained mud and sand deposited in backwater areas supporting nonpersistent emergent wetlands.

Measured tissue concentrations

The lack of plant contaminant uptake indicates minimal COPC exposure (Section 4.0, Table 4-21). Some COPCs are detected in plants, but tissue concentrations do not correlate with abiotic soil concentrations in the riparian zone.

Survival, growth from toxicity testing

As indicated for the upland sites, the results of Sandberg's bluegrass bioassays for the riparian zone samples were not usable for the risk assessment. These results are available from the GiSdT database (http://rcbra100-300.neptuneinc.org/rcbra100-300/home/index.xml).

Riparian Plant Risk Summary

The observation of highest diversity and richness in riparian sites with the highest metal levels in soil suggests that there are no adverse impacts on plants from COPCs. Some COPCs are detected in riparian plants, but concentrations of COPCs in plants do not correlate with abiotic media concentrations. Another measure of risks to riparian plants is based on comparisons of soil concentrations to screening benchmarks. Riparian plant HIs based on these benchmarks are greater than one for all sites but are not different between operational and reference sites, indicating that risks to plants are largely based on concentrations of naturally occurring elements in soil and not due to other COPCs. The weight attributed to this LOE is low. There were also no significant positive correlations of concentrations of COPCs in soil versus plant tissues. A medium-weighted LOE involves field measures of plant diversity, richness, and cover at operational areas compared to reference sites; no difference in these field measures are noted between riparian operational sites and reference sites. Although the highest weighted LOE, toxicity testing, showed no differences in plant growth between operational sites and reference sites, these results are compromised by issues with laboratory test methodology and are not being used as a basis for conclusions on plant effects.

6.4.2.2 Riparian Invertebrates

Literature values for survival, growth, or reproduction

Invertebrate HQs are based on comparing COPC concentrations in riparian soil to screening benchmarks for terrestrial invertebrates (Appendix H, Section H-2). Hazard indices for riparian invertebrates (Figures 6-17a and 6-17b) are summed HQs and are elevated above one but are not significantly different between upland remediated waste sites and reference sites (Student's t test, α=0.05). The weight associated with this LOE is low.

Diversity and abundance from pitfall traps

Similar to the upland zone, hand-picking terrestrial invertebrates in the riparian zone was necessary to gain sufficient mass for analytical COPC measurements. While facilitating laboratory analyses, this collection approach confounded field data-based estimates of relative abundance as a LOE.

Measured tissue concentrations

In an evaluation of statistically significant regressions and positive relationships for soil to biotic tissue concentrations, only 2% of the correlations qualified (α=0.05) (Section 4.0, Table 4-21). In other words, the frequency of statistically significant correlations observed between contaminants in soil invertebrates and soil across riparian sites would be expected based on chance alone.

Survival from toxicity testing

Invertebrate toxicity testing was carried in the same manner as for upland soils. Figure 6-18a shows the results of riparian nematode survival. Nematode survival was lower in riparian soils compared to upland soils and significantly correlated ($p=0.0002$) with soil pH (Figure 6-18b). There are no statistically significant differences in nematode survival between riparian operational and riparian reference sites (Student's t test, $\alpha=0.05$). Nematode survival correlated with 2 detected soil or invertebrate tissue COPC concentrations out of 233 possible models, which is less than 1% frequency and consistent with the frequency expected based on the 5% significance level tested (Table H-7-8). The weight associated with this LOE is high.

Riparian Invertebrate Risk Summary

The WOE indicates that COPCs do not adversely impact riparian invertebrates. The highest weighted LOE was the toxicity bioassay of nematode survival. While survival was significantly lower in riparian soils compared to upland soils, survival was not significantly different between riparian operational sites and reference site soils. Some COPCs were detected in riparian invertebrates, but concentrations of COPCs in invertebrates at operational sites generally do not correlate with soil concentrations. As with upland site invertebrate field-measures, the sample collection method did not permit estimates of invertebrate abundance. Although HIs for riparian invertebrates are greater than one at all sites, they are not different between operational sites and reference sites and are primarily related to naturally occurring constituents in soil.

6.4.2.3 Riparian Middle Trophic-Level Species

Literature values for survival, growth, or reproduction compared to modeled exposure

One measure of radionuclide risk to wildlife is assessed by the SOF (i.e., the sum of ratios of radionuclide activities in soil to BCGs). The SOFs for riparian wildlife in remediated waste sites and reference sites are considerably less than one (Figures 6-19a and 6-19b). While the SOF is statistically significantly higher in riparian operational soils (Student's t test, $\alpha=0.05$, $p=0.01$, unequal variance), these results show that even the highest site-specific SOF for riparian wildlife is less than 5% of the dose limits proposed in BDAC guidance (DOE-STD-1153-2002).

Mourning dove HQs are based on comparing estimated ingested dose from soil and diet (soil ingestion and 100% plant diet; Appendix H, Section H-1) to COPC-specific TRVs for birds (Appendix H, Section H-3). Hazard indices for mourning doves (Figures 6-20a and 6-20b) are summed HQs and are elevated above one but are not significantly different between riparian operational sites and reference sites (Student's t test, $\alpha=0.05$). The main contributor to elevated HIs are vanadium and nondetected PCBs reported at half their detection limit (Appendix H, Section H-4, mourning dove).

Pocket mouse HQs are based on comparing COPC exposure from soil and diet (soil ingestion and 100% plant diet; Appendix H, Section H-1) to COPC-specific TRVs for mammals (Appendix H, Section H-3). Hazard indices for pocket mice (Figures 6-21a and b) are summed HQs and are elevated above one but are not significantly different between riparian operational sites and reference sites (Student's t test, α=0.05). The main contributors to elevated HIs are nondetected PCBs reported at half their detection limits (Appendix H, Section H-4, pocket mouse).

Meadowlark HQs are based on comparing COPC exposure from soil and diet (soil ingestion and 37% plant and 63% terrestrial invertebrate diet; Appendix H, Section H-1) to COPC-specific TRVs for birds (Appendix H, Section H-3). Hazard indices for meadowlarks (Figures 6-22a and 6-22b) are summed HQs and are elevated above one but are not significantly different between riparian operational sites and reference sites (Student's t test, α=0.05). Vanadium and di-n-butylphthalate are the main contributors to elevated HIs for meadowlarks (Appendix H, Figure H-4, meadowlark).

Deer mouse HQs are based on comparing COPC exposure from soil and diet (soil ingestion and 50% plant and 50% terrestrial invertebrate diet; Section H-1) to COPC-specific TRVs for mammals (Appendix H, Section H-3). Hazard indices for deer mice (Figures 6-23a and 6-23b) are summed HQs and are elevated above one but are not significantly different between riparian operational sites and reference sites (Student's t test, α=0.05). The main contributors to elevated HIs are nondetected PCBs reported at half their detection limits (Appendix H, Section H-4, deer mouse).

Killdeer HQs are based on comparing COPC exposure from soil and diet (soil ingestion and 100% terrestrial invertebrate diet; Section H-1) to COPC-specific TRVs for birds (Appendix H, Section H-3). Hazard indices for killdeer (Figures 6-24a and 6-24b) are summed HQs and are elevated above one but are not significantly different between riparian operational sites and reference sites (Student's t test, α=0.05). Vanadium, selenium, and copper are the main contributors to elevated HIs for killdeer (Appendix H, Section H-4, killdeer).

Grasshopper mouse HQs are based on comparing COPC exposure from soil and diet (soil ingestion and 100% terrestrial invertebrate diet; Section H-1) to COPC-specific TRVs for mammals (Appendix H, Section H-3). Hazard indices for grasshopper mice (Figures 6-25a and 6-25b) are summed HQs and are elevated above one but are not significantly different between riparian operational sites and reference sites (Student's t test, α=0.05). The main contributors to elevated HIs are selenium and thallium (Appendix H, Section H-4, grasshopper mouse); the average HQs for both are slightly higher than one. Selenium is not elevated in soil based on comparisons to background and reference site concentrations, but thallium is associated with Hanford Site operations (Section 4.0).

Kingbird HQs are based on comparing COPC exposure from soil and diet (soil ingestion and 100% terrestrial invertebrate diet; Appendix H, Section H-1) to COPC-specific TRVs for birds (Appendix H, Section H-3). Hazard indices for kingbirds (Figures 6-26a and 6-26b) are summed HQs and are elevated above one but are not significantly different between riparian operational sites and reference sites (Student's t test, α=0.05). Vanadium, selenium, and copper are the main contributors to elevated HIs for kingbirds (Appendix H, Section H-4, kingbird).

Measured tissue concentrations

In an evaluation of statistically significant regressions and positive relationships for soil to biotic tissue concentrations, only 2% of the correlations qualified (α=0.05) (Section 4.0, Table 4-21). Cadmium, chromium, and tin in soil were significantly correlated to levels in small mammal tissue. However, the frequency of statistically significant correlations observed between contaminants in mammals and soil across riparian sites would be expected based on chance alone.

Literature values for survival, growth or reproduction compared to measured exposure

COPCs in small mammal livers are compared to the threshold for tissue effects based on literature data. Mammalian liver tissue effects levels are found in Appendix H, Section H-6; in these figures, operational refers to riparian soils, reference refers to samples from both riparian and upland reference sites, as applicable, and waste sites are upland soil sites. As shown in Appendix H, Figures H-6-1-1 through H-6-1-4, only lead in mammal liver tissue from a reference site exceeded its tissue no-effect level. Mean small mammal tissue (liver) contaminant concentrations at upland waste sites are not greater than at reference sites and do not increase along an increasing contamination gradient (Section 4.0). The weight of this LOE is medium.

Field studies: Avian reproductive success, small mammal balanced gender ratios, juvenile recruitment, relative abundance, gross morphology

Due to heavy nest predation by crows and ravens, the planned estimate of kingbird reproductive success was compromised. A total of 41 nests were identified and 10% were occupied but had not produced eggs. Of those nests with observed eggs and/or juveniles more than half were either predated or abandoned by the parents. Fledglings were successfully collected from only nine (21%) of the remaining nests (Table 6-3). These confounding factors did not allow for accurate estimates of kingbird breeding success.

As with upland sites, deer mice and Great Basin pocket mice represented the majority of small mammals in the riparian investigation areas. Summary results of mammal field measures are shown in Figures 6-27a, 6-27b, and 6-27c; additional information is available in Appendix H, Section H-9. On average, more males than females were collected at riparian operational sites while reference site gender ratios approached unity. But the total females and total males did not differ significantly among the sites (Appendix H, Section H-9). And while gender ratios in riparian operational sites deviated slightly from equality, with more males than females captured, the difference between operational and reference sites was not statistically significant (Student's t test, α=0.05) (Figure 6-27a). Mammal relative abundance (number collected divided by trap nights) and total mammals trapped per site were fairly evenly distributed across riparian terrestrial sites (Figures 6-27b and 6-27c) and associated with the plant community. For example, relative to upland sites, plant diversity and species richness were highest in riparian operational soils. One terrestrial investigation area, Riparian site #6, had the highest relative small mammal abundance, which was approximately two to six times that of other sites. This site also had the highest plant cover. Statistical correlations with plant community metrics show that there is a positive significant relationship between total mammals trapped and total plant cover (p=0.004), but there were no other significant correlations between mammalian metrics and other aspects of the floral community.

Comparison of small mammal population measures (female or male reproductive frequency, relative abundance, or gender ratios) to small mammal COPCs identified a total of 12 COPCs in small mammal tissues (Table H-7-9). Two of these 12 COPCs are organic chemicals (Aroclor-1254 and Aroclor-1260) that were only detected once in small mammal tissue. The other COPCs are inorganic chemicals that are commonly detected in mammalian tissues.

Riparian Middle Trophic-Level Risk Summary

Based on the LOEs, while there are data gaps for avian field measures of nest success, there is no indication of risk to birds from COPCs. Given the importance of invertivorous birds as representative and potentially sensitive biota, exposure of aerial insectivores to emergent insects from the river was considered. The data from the rock baskets were used as a measure of the emergent insects, which is appropriate because larval stages of some emergent insects were sampled from the baskets. Risks to birds consuming either invertebrates on the ground or benthic macroinvertebrates were comparable between reference areas and riparian operational sites. An evaluation of kingbird abundance and reproductive success was confounded by heavy nest predation from crows and ravens.

Overall, risks to small mammals from COPCs, a focal taxon of this investigation, are not indicated. Small mammal relative abundance was slightly higher in riparian operational sites versus and reference sites. In general, small mammal population metrics can be explained by characteristics of the plant community. Gross morphological anomalies were not evident in field-collected animals, and there was limited evidence of contaminant uptake. Significant correlations between COPCs in soil and in mouse tissue occurred no more frequently than would be expected based on chance alone. Indications of reproductive differences were not apparent for small mammals inhabiting operational sites relative to reference locations. Hazard indices for small mammals occupying all trophic levels were uniformly above one but are similar between riparian operational and reference locations.

6.4.2.4 Riparian Upper Trophic-Level Species

Literature values for survival, growth, or reproduction compared to modeled exposure

Considering their mobility, badgers constitute the mammalian component of RCBRA multi-media receptors that can obtain surface water from the river for drinking in the course of foraging over riparian sites. Badger HQs are based on comparing COPC exposure from soil and diet (soil and surface water ingestion and 100% small mammal diet; Appendix H, Section H-1) to COPC-specific TRVs for mammals (Appendix H, Section H-3). Hazard indices for badgers drinking river water and consuming soil and small mammals (Figures 6-28a and 6-28b) are summed HQs and are elevated above one but are not significantly different between upland remediated waste sites and reference sites (Student's t test, α=0.05). Because exposure to COPCs in surface water was negligible, HI results for aquatic sites were not included in the plots. The main contributor to elevated HIs is thallium (Appendix H, Section H-4, badger).

Red-tailed hawks were modeled as higher trophic levels exposed to multiple media, gathering prey from riparian terrestrial sites (27% birds and 73% mammals in riparian area; and 100% birds at aquatic sites; Appendix H, Section H-1), and in the course of foraging in riparian areas (receiving exposure to soil in the process), they could theoretically obtain surface water from the river for drinking. Hawk HQs are based on comparing COPC exposure from soil and diet (soil and surface water ingestion and 100% small mammal diet in upland area; Appendix H, Section H-1) to COPC-specific TRVs for birds (Appendix H, Section H-3). Hazard indices for hawks consuming soil, surface water, and small mammals and birds are presented in Figures 6-29a and 6-29b. Because exposure to COPCs in surface water was negligible, HI results for aquatic sites were not included in the plots. Hazard indices for red-tailed hawks are below one on average, suggesting low potential for risk. In addition, HIs are not statistically significantly different when comparing the upland waste and reference sites (Student's t test, α=0.05).

Riparian Upper Trophic-Level Risk Summary

Risks to upper trophic-level birds are negligible on the basis of modeled dietary exposure. Through modeling, red-tailed hawks were exposed to multiple media, obtaining soil in their diet, ingesting small mammals and kingbirds, and drinking water from the river. Hazard indices were low and not significantly different among locations. Hawk risks would be further reduced considering a realistic home range and area-use factors for these receptors.

Risks to upper trophic-level mammals are negligible on the basis of modeled dietary exposure. Badgers were exposed to multiple media through ecological exposure models, obtaining soil in their diet, ingesting small mammals, and drinking water from the river. Risks to upper trophic-level mammals are indicated by elevated HIs (HI of about 10) on the basis of modeled dietary exposure from individual sites. However, HIs are similar between remediated waste and reference sites and risks would be further reduced when considering a realistic home range and area-use factor for these receptors.

Summary of Terrestrial Lines of Evidence

Considering commonalities in ecological characteristics and assessment endpoints between terrestrial upland and riparian zones, LOEs for these soil environments are summarized together (Table 6-4). Each LOE is linked to the terrestrial risk question serving as the basis for that particular measure and the measure's risk conclusions are summarized.

6.4.3 Risks to Near-Shore Receptors

Risks to near-shore receptors are characterized according to assessment endpoints developed for this exposure zone. Assessment endpoints include lower trophic level producers and invertebrates, amphibians, and middle to upper trophic-level fish, birds, and mammals (invertivores and piscivores). Risks to near-shore assessment endpoints are based on multiple LOEs as described below.

6.4.3.1 Near-Shore Plants

Survival, growth from toxicity testing

For testing sediment toxicity with aquatic plants, pakchoi (*Brassica chinensis*), a cultivated member of the mustard family, served as a surrogate for evaluating adverse effects of contaminated sediments on the T&E plants White Bluffs bladderpod *(Lesquerella tuplashensis)* and persistent sepal yellowcress (*Rorippa columbiae*). Sediment phytotoxicity testing followed Chen et al. (2002), and the results of the assay are presented in Figure 6-30 showing pakchoi growth (shoot dry weight) in sediments. Differences in growth (shoot weight) between operational site sediments and their corresponding reference sediments were evaluated using Dunnett's multiple comparison t-test (α=0.05). Biomass was lowest for plants grown in sediments from the strontium plume but not significantly different compared from that in reference site sediments or in sediments from the other plume areas.

Aquatic Plant Risk Summary

Uncertainties exist with regard to possible impacts on near-shore plants from sediment COPCs; these uncertainties can be addressed with the expanded sediment bioassay data being compiled for the Inter-Areas shoreline assessment. For sediment, phytotoxicity bioassay (with pakchoi) results suggest that growth was reduced in sediments collected in the strontium plume associated with the 100-N Area. However, there are no relationships between the bioassay results and strontium levels in any of the sediment sampling locations. In addition there are very few macrophytes along most of the operational areas, most likely due to the strong and variable river flows.

6.4.3.2 Near-Shore Benthic Macroinvertebrates

Literature values for survival, growth, or reproduction

Aquatic biota HQs are based on comparing COPC concentrations in pore water to screening benchmarks for aquatic organisms (Appendix H, Section H-2). Hazard indices for aquatic biota (Figures 6-31a and b) are summed HQs and are elevated above one but are not significantly different between aquatic operational sites and reference sites (Student's t test, α=0.05). The main contributors to elevated HIs are barium, cadmium, methoxychlor, silver, and uranium (Appendix H, Figure H-4, aquatic biota), which are associated with Hanford Site operations based on comparisons to reference site concentrations (Section 4.0).

Sediment biota HQs are based on comparing COPC concentrations in sediment to screening benchmarks for sediment-associated organisms (Appendix H, Section H-2). Hazard indices for aquatic biota (Figures 6-32a and b) are summed HQs and are elevated above one but are not significantly different between aquatic operational sites and reference sites (Student's t test, α=0.05). The main contributor to an elevated HI is barium (Appendix H, Section H-4, sediment biota), which is associated with Hanford Site operations based on comparisons to reference site concentrations (Section 4.0).

Measured tissue concentrations

In an evaluation of statistically significant positive relationships between sediment and pore water to biotic tissue concentrations (Section 4.0, Tables 4-22 and 4-23, respectively), the frequency was within that expected based on chance alone (α=0.05). There were few statistically significant correlations between analytes in pore water (only iron and potassium) and sediment (only potassium and tin) with tissues of aquatic organisms, indicating a lack of COPC exposure to these assessment endpoints.

Literature values for survival, growth, or reproduction compared to measured exposure

COPCs in clam soft tissue are compared to the threshold for tissue effects based on literature data. Clam soft tissue effects levels are found in Appendix H (Section H-6) and the data are plotted Hanford River mile. As shown in Figures H-6-4-1 through H-6-4-5, mercury in clam soft tissue is greater than the no-effect concentration at some upstream and operational locations.

COPCs in benthic macroinvertebrate tissues are compared to the threshold for tissue effects based on literature data (Appendix H-6, Section H-6) and plotted by Hanford River mile. As shown in Figures H-6-5-1 through H-6-5-4, the concentrations of all COPCs in benthic marcroinvertebrate tissue are less than tissue effect levels with the exception of selenium, which exceeds the no-effect level and approaches concentrations associated with 50% reduced survival. This exceedance was observed in aquatic macroinvertebrates at upstream and immediately downstream locations.

In situ clam survival

Clam survival was assessed by location. Six cam tubes, consisting of 25 individuals per tube, were deployed at the chromium- and uranium-plume RCBRA near-shore aquatic investigation areas. Clam tubes were not deployed in the strontium plume because bivalve data were collected there through previous complementary investigations (DOE/RL-2005-22). Clam survival was affected by floating tubes (i.e., tubes that became dislodged from the river bed and hung suspended in the current). Mortality was elevated in such tubes, presumably because the clams were suspended too far from the river bed, unable to filter enough food from the water column to survive. In addition, it appeared that plant intrusion into the tubes affected mortality. Floating tubes affected 16% of the total tubes deployed; plant intrusion affected 6%. Statistical analyses showed that clam survival was significantly affected by floating tubes (Student's t test, α=0.05, $p<0.0001$) and plant intrusion (Student's t test, α=0.05, $p=0.012$). Consequently results affected by these factors were not included in plots and analyses of clam survival.

Differences in survival between operational plume areas and corresponding reference sites were evaluated using Dunnett's multiple comparison t-test after accounting for confounding factors associated with field deployment. Clam survival was significantly ($p<0.05$) reduced in the chromium plume relative to survival in the uranium plume and reference site locations (Figure 6-33a). A gradient analysis of clam survival and pore water and clam tissue COPC concentrations suggested that there was an important factor of particle size on clam survival (Figure 6-33b); as the fraction of total sand increased, clam survival significantly decreased (r^2=0.41, n=23, p=0.001). Analysis of clam survival residuals (the variability in survival not explained by particle size) showed no statistically significant relationships with pore water chromium or other COPCs and survival. However, significant negative correlations were observed between clam survival and primarily pesticide COPC concentrations in clam tissue (Appendix H, Section H-7, Table H-7-1). It should be noted that 474 correlations of residual clam survival and tissue COPCs yielded 8 significant ($p<0.05$), negative relationships or less than 2%; in other words, the number of significant relationships expected based on chance alone given a significance level of α=0.05.

Clam histopathology

Contingency analyses were performed to determine if the number of occurrences of a particular histopathological score differed significantly from the number that was expected (statistically) if the scores are independent of location (operational area versus reference area). Statistically different observations between operational and reference site clams were observed for two histopathological measurements. Incidence of digestive system epithelial cell shedding was observed at rate higher than expected in operational area samples (Chi-square = 8.2, p = 0.04). Also, the count of reproductive system follicle cysts was statistically greater than expected in reference site clam samples (Chi-square = 6.2, p = 0.01). Gradient analyses were performed for the two significantly different clam histopathology endpoints. Follicle cysts and epithelial cell shedding were regressed against 512 potential correlates (COPCs in clam tissue and pore water) and 3 of 512 were significant ($p<0.05$) (Appendix H, Section H-7, Table H-7-2), which is less than the number of significant relationships one might expect based on chance alone given a significance level of α=0.05.

No statistical differences were apparent for observed versus expected occurrence of histopathology scores for any other of the 19 remaining measurements (Table 6-5; Appendix H, Section H-8). Descriptions of morphology and histopathology measurements and the contingency tables detailing the number of observations per score versus expected occurrence are provided in Appendix H, Section H-8.

Survival, growth, and reproduction from toxicity testing

ASTM E1295-01, *Standard Guide for Conducting Three-Brood, Renewal Toxicity Tests with Ceriodaphnia dubia*, offers a time-tested protocol for assessing adverse effects of contaminants in water. This test evaluates the survival and reproduction of water-column-dwelling invertebrates. Relative to other common laboratory species, the American Society for Testing and Materials (ASTM) recommended test species *C. dubia* is extremely sensitive to heavy metals. A test begins when less than 12-hour-old neonates are first placed in test solutions. At 25 °C, control organisms should produce three broods in 7 days. The number of neonates produced by each first-generation *C. dubia* in each brood is recorded. The reproduction endpoint may provide insights not achieved by survival data for toxic effects of aquatic contaminants. Thus, ASTM E1295-01 provides survival and reproduction as test endpoints.

Figure 6-34a shows the results of *Ceriodaphnia* survival, and Figure 6-34b shows the results of *Ceriodaphnia* reproduction. Differences in survival and reproduction between operational and reference pore water samples were evaluated using Dunnett's multiple comparison t-test (α=0.05). The *Ceriodaphnia* tests passed acceptance criteria in the presence of the positive control (sodium chloride), and there were no significant differences in survival and reproduction among pore water samples from aquatic stations in the operational plumes versus reference site samples. This finding suggests that organisms inhabiting the hyporheic zone interstitial waters are not adversely affected by contamination from Hanford Site operations.

For evaluating sediment toxicity with aquatic fauna, particularly those more representative of hyporheic organisms, sediment bioassays were performed using a 28-day test of the survival of invertebrates in contaminated sediments. ASTM E1706-05, *Standard Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Fresh Water Invertebrates*, offers a time-tested protocol for assessing adverse effects of contaminants. Relative to common laboratory species, the ASTM-recommended test species *Hyalella azteca* is extremely sensitive to heavy metals. *H. azteca* consumes decaying organic matter, lives on the sediment surface, and burrows into sediments (at least in laboratory settings), representing a highly exposed organism for metal-contaminated groundwater upwelling through hyporheic sediments. An evaluation of aquatic test species by Ecology (1992a) has shown that this organism most consistently exhibits a dose response to contaminants in a variety of aquatic habitats. *Hyalella* endpoints include survival and growth.

Differences in growth and survival between operational site sediments and their corresponding reference sediments were evaluated using Dunnett's multiple comparison t-test. For *H. azteca*, growth and survival were significantly reduced ($p<0.05$) in the chromium plume relative to growth and survival in reference site sediments (Figures 6-35a and b). Sediment particle size and selenium were correlated with *Hyalella* survival and growth (Appendix H, Section H-7).

Field measures of diversity and abundance

Based on analysis of rock baskets, 59 nine unique benthic macroinvertebrate taxa were identified from the entire set rock basket samples deployed in the Hanford Reach. Most of the insects and the mollusks were identified to the genus/species level. The Chironomidae were abundant in the samples and if identified to the genus/species group level would probably account for about 15 to 20 additional insect taxa. Oligochaeta worms were less abundant, but could add about six taxa if they were identified to the lowest practical level. Of the taxa identified to genus or species, most are broadly distributed in western North America, many are transcontinental, and a few are cosmopolitan.

The 59 taxa identified were evenly split between noninsect invertebrates (30) and insects (29). Mollusks (16 taxa) and Crustacea (7 taxa) were the dominant noninsect groups. Other noninsect taxa included miscellaneous vermiform taxa, hydroids (*Hydra*) and freshwater mites (Acari). *Ephemeroptera* (mayfly) and *Trichoptera* (caddisfly) were the dominant insect groups, each with 11 taxa. Other insect taxa included one damselfly (*Odonata*), one aquatic moth (*Lepidoptera*), two riffle beetles (*Coleoptera*), and two true flies besides the *Chironomidae* (*Diptera*). No stoneflies (*Plecoptera*) and no true bugs (*Hemiptera*) were found.

Biological community information such as this integrates past chemical, physical, and biological events, both short-and long-term, and directly evaluates the condition of the water resource. To help interpret large data sets of biological community information, biological indices are often used. One example, the Hilsenhoff Family Biotic Index provides an estimate of water quality using established tolerance values for each taxa. Tolerance referred to here is a general tolerance to warm water temperature, low dissolved oxygen levels, and to some extent fine sediment and filamentous algae. A modified Hilsenhoff Biotic Index that assigns tolerance values ranging from 0 (least tolerant) to 10 (highly tolerant), then computes an average weighted tolerance value for a benthic invertebrate community represented in a sample, has been routinely used in freshwater bioassessment studies. The community information summarized by this index for aquatic stations in the reference area and uranium plumes indicates that these areas are comparable with respect to water quality (Figure 6-36); stations surveyed from the chromium area are indicative of higher water quality.

This index was originally constructed to examine nutrient enrichment only in Great Lakes area streams. Application of the Hilsenhoff Biotic Index to western North American benthic communities to examine "general tolerance" remains tentative as no empirically derived tolerance values are available for western taxa. To examine general tolerance in western North American benthic communities, it may be more useful to use two metrics, percent tolerant taxa and number of tolerant taxa. In the case of the Hanford Reach basket samples, these metrics were calculated as shown in (Figures 6-37 and 6-38). Differences in tolerant taxa between operational plume areas and corresponding reference sites were evaluated using Dunnett's multiple comparison t-test. The total number of tolerant taxa per site was not significantly different; however, the percent of such taxa at chromium plume stations was significantly lower than the other locations surveyed ($p<0.05$).

Oligochaeta worms and Chironomidae were excluded from the calculation because they were not identified to a low enough taxonomic level to distinguish tolerant taxa. Even after excluding the Oligochaeta and Chironomidae, tolerant taxa in the Hanford Reach were both numerous and diverse. The percent tolerant taxa at the chromium array stations were often inversely related to tolerant taxa richness. High variation is seen in the richness and dominance of tolerant taxa at the reference stations. Reference sites 11, 12, and 16 had the highest percent tolerant taxa of all the Hanford Reach stations, while sites 13 and 14 were among the lowest. Tolerant taxa dominance and richness at the reference stations appears to be greatest where embeddedness and macrophyte coverage is highest (Table 6-6a). The greatest richness of tolerant taxa was found at Chromium sites 1-3 and 5, where the lowest percent of tolerant taxa occurred (Table 6-6b). Chromium site 6 had a high percent of tolerant taxa relative to the other chromium stations. Uranium array stations had both a higher average percent and number of tolerant taxa than the chromium stations. Uranium site 4 had the lowest percent and number of tolerant taxa, mainly due to the very low abundance and richness of tolerant crustaceans and mollusks (Table 6-6c).

Given the predominance of inorganic chemicals as Hanford Site contaminants, it is particularly important to understand the effects of heavy metals on benthic macroinvertebrate communities. Numerous researchers have shown a decline in total taxa and diversity in response to heavy metals (Clements et al. 1988, Clements 1994, Kiffney and Clements 1994, Maret et al. 2003).

Invertebrate diversity and abundance and number of taxa in the chromium and uranium plumes relative to reference site stations were evaluated using Dunnett's multiple comparison t-test (α=0.05). The number of invertebrate taxa was not significantly different among plume and reference areas (Figure 6-39), but total diversity (Figure 6-40) is significantly lower and total invertebrate abundance (Figure 6-41) is significantly higher at the chromium plume aquatic stations relative to the uranium plume and reference site stations. While total diversity is negatively correlated with chromium and nickel in pore water (Appendix H, Section H-7), the lower diversity in the chromium plume may also be explained by habitat crowding from net-spinning caddisflies (Figure 6-42). *Cheumatopsyche* and *Hydropsyche* (Hydropsychidae) construct retreats and spin nets of silk to capture a variety of particles for food, including fine particulate organic matter, algae, and small invertebrates. *Polycentropus* (Polycentropodidae) is primarily a predator of other benthic invertebrates and captures prey either with a silk net or by roaming as a free-living larvae. Net-spinning caddisflies (Trichoptera) were often dominant organisms in rock baskets; densities of several thousand organisms per basket in the chromium plume stations are high enough to ensure that much of rock surface area and crevices between rocks are covered with silk. Densities as high as this can inhibit and suppress other benthic invertebrate taxa.

Hydropsychidae (net-spinning Trichoptera) have been reported as less sensitive to heavy metals, often "blooming" downstream of a metals input area (Clements et al. 1988, Clements 1994). However, there is no evidence of elevated metals in pore water or sediments in aquatic stations with abundant net-spinning caddisflies. Considering other benthic macroinvertebrate community metrics in relation to heavy metal contamination, several authors have reported declines in metals sensitive Ephemeroptera (mayflies) individuals in the presence of heavy metal contamination (Clements et al. 1988, Clements 1994, Kiffney and Clements 1994, Maret et al. 2003). To evaluate this possibility in the Hanford Reach, the abundance and total number of mayflies are shown in Figures 6-43 and 6-44. Differences between operational plume areas and corresponding reference sites were evaluated using Dunnett's multiple comparison t-test. There are no significant differences in mayfly total abundance or number of taxa among chromium, uranium, or reference sites.

The total number of taxa comprising the benthic community at each of the 26 stations varied from a low of 12 taxa at reference site 14 to 38 at uranium site 6 (Tables 6-6a and 6-6c). In contrast to most benthic communities found in hard-bottomed, mid-order streams in the Pacific Northwest, the number of noninsect taxa found at the Hanford Reach stations equaled or exceeded the number of insect taxa identified. Even though inclusion of the *Chironomidae* at the genus/species group level would in most cases reverse the ratio, the number of noninsect taxa found at the Hanford Reach stations is comparatively high for streams and rivers in the region. Taxa richness at stations in the reference array was variable, with reference site 14 having the lowest total richness and lowest insect richness of all stations, to reference station R300-2 having among the highest total and noninsect taxa richness. Habitat conditions were the most variable at this array and probably account for much of the variation in taxa richness seen (Appendix H, Tables H-9-1-1, H-9-1-2, and H-9-1-3).

Of the benthic macroinvertebrate community, mollusks are of particular interest because several special status species occur in the Hanford Reach. Biologists with expertise in mollusk identification assessed organisms colonizing rock baskets for a comprehensive species inventory and assessment of molluska diversity. Overall, the study sites have a moderately diverse freshwater mollusk fauna, perhaps of up to 20 species (18 native) that are characteristic of slack water, reservoir, backwater, or impoundment habitats of Washington and of limited parts of the Columbia system in other states. Candidates for listing status, *Fluminicola fuscus* and *Fisherola nuttalli*, are rarely present and there are relatively few endemic or sensitive taxa, perhaps because most of such taxa are characteristic of more oligotrophic, cold, hard-substrate, swift-flowing streams or springs in Washington. Statistical analyses of mollusk diversity (Figure 6-45) and the number of mollusk taxa and rare taxa (Section H-9-4) in operational plume areas and corresponding reference sites were evaluated using Dunnett's multiple comparison t-test (α=0.05).

More details on mollusk observations along the Hanford Reach of the Columbia River for the RCBRA are available in Appendix H (Section H-9). Mollusk diversity and the number of molluska taxa (Figure H-9-2-1) were not different among the plumes. And while mollusk diversity for one station (uranium-4) in the uranium plume was zero, overall the number of rare molluska taxa (Figure H-9-1-2) was significantly higher at stations located in the uranium plume. Tables H-9-5, H-9-6, and H-9-7 list the average number of mollusk species collected per rock basket in reference sites and uranium and chromium stations, respectively.

Benthic Macroinvertebrate Risk Summary

Community metrics do not suggest that contaminant-related impacts are evident to benthic macroinvertebrates in aquatic operational sites. However, risks to aquatic macroinvertebrates based on the highest weighted LOEs, toxicity testing and histopathology, show some relationships with confounding factors (mainly particle size) and COPCs. Additional data from the Inter-Areas shoreline assessment would help to understand better the influence of confounding factors and better understand the potential for adverse ecological effects of COPC concentrations on benthic macroinvertebrates.

6.4.3.3 Near-Shore Amphibians

Measured tissue concentrations

Amphibians were targeted for collection and tissue analyses in this assessment, but field efforts were unsuccessful in gathering animals. This LOE was consequently unavailable for use in an assessment of risk to amphibians.

Survival, malformation, and growth based on toxicity testing

Pore water was used as the exposure medium for the bioassay ASTM E1439-98, *Standard Guide for Conducting the Frog Embryo Teratogenesis Assay-Xenopus* (FETAX) to test the developmental impact of water contaminants on amphibians. Since the assay is based on the whole embryo and not on embryo parts or cultured cells, the endpoints account for important cellular and molecular mechanisms that may be subject to toxicological impacts. The FETAX assay is a 4-day continuous exposure that covers primary organogenesis that ensures that all sensitive early life stages are evaluated. The endpoints of a FETAX assay include growth, deformities, and survival. The *Xenopus* tests passed acceptance criteria in the presence of the positive control (6-AN).

Differences in survival, malformations, and growth between operational and reference pore water samples were evaluated using Dunnett's multiple comparison t-test (α=0.05). Relative to survival in pore water from reference sites, survival associated with chromium and strontium plumes is slightly yet significantly reduced for *Xenopus* embryos; mean survival in reference, chromium, and strontium pore water is 99.7%, 98%, and 97%, respectively (Figure 6-46a). There were no differences in percent deformities among the sites (Figure 6-46b), but growth was significantly reduced in pore water from the strontium plume stations ($P<0.05$) (Figure 6-46c). The endpoints growth and survival were correlated to 172 COPCs in pore water, and the 3 significant negative relationships (less than 2%) were within the frequency that would be expected based on chance alone given a significance level of α=5% (Appendix H, Section H-7, Table H-7-3).

Amphibian Risk Summary

The results of FETAX bioassays show that survival and growth differences between operational and reference areas, while statistically significant, are slight and likely not ecologically relevant. In addition, difference in FETAX measures were not generally associated with differences in COPC concentrations. Although the initial pore water samples may have represented mostly river water during the initial sampling events at many sampling stations, subsequent pore water sampling obtained more representative pore water samples. Tissue samples of amphibians were not collected due to a lack of available organisms, which makes field measures of exposure to amphibians a data gap. The Inter-Areas shoreline assessment is planning to fill this data gap. However, the available data do not suggest that COPC concentrations are adversely affecting amphibian survival and growth.

6.4.3.4 Near-Shore Middle to Upper Trophic-Level Fish, Birds, and Mammals

Literature values for bird and mammal survival, growth, or reproduction

One measure of radionuclide risk to aquatic wildlife is assessed by the SOF (i.e., the sum of ratios of radionuclide activities in soil to BCGs). The SOFs approach one for near-shore wildlife associated with water in plume areas and reference sites (Figures 6-47a and 6-47b). While these results show that the higher site-specific SOFs for aquatic wildlife is about 80% of the dose limits proposed in BDAC guidance (DOE-STD-1153-2002), the elevated SOF is a function of substituting half the detection limit as a representative concentration for radionuclides that were not detected in water. Furthermore, the SOF is not statistically significantly higher in near-shore plume areas (Student's t test, α=0.05) than in water at reference sites. The SOFs for near-shore wildlife associated with sediment in plume areas and reference sites (Figures 6-48a and 6-48b) are <1% of the dose limits proposed in BDAC guidance (DOE-STD-1153-2002). Furthermore, the SOF is not statistically significantly higher in near-shore plume area sediments than in sediment at reference sites (Student's t test, α=0.05).

Kingbird HQs are based on comparing COPC exposure from water and diet (surface water ingestion and 100% benthic macroinvertebrate [assumed to be emergent aquatic insects] Appendix H, Section H-1) to COPC-specific TRVs for birds (Appendix H, Section H-3). Because benthic macroinvertebrate baskets were not deployed in the strontium plume and were also not recovered from chromium station 8, there were no data for modeling kingbird dietary exposure to benthic macroinvertebrates in these areas. Consequently, HQ/HI results could not be calculated from these aquatic sites. Hazard indices for kingbirds (Figures 6-49a and 6-49b) are summed HQs and are elevated above one but are not significantly different between near-shore operational and reference areas (Student's t test, α=0.05). Copper is the main contributor to elevated HIs for kingbirds (Appendix H, Section H-4, kingbird). It is worth noting that risk from copper is likely overestimated. To meet sample mass requirements for COPCs in benthic macroinvertebrate tissue, crayfish were collected and, consequently, kingbird-modeled ingestion prey was based on crayfish data. Such organisms have naturally elevated copper levels considering that their respiratory transport system is based on hemocyanin, a bluish, copper-containing protein like hemoglobin that serves as an oxygen-carrier in the blood of crustaceans.

Bufflehead duck HQs are based on comparing COPC exposure from sediment and diet (sediment ingestion and 50% clam and 50% benthic macroinvertebrate diet; Appendix H, Section H-1) to COPC-specific TRVs for birds (Section H-3). The bufflehead is primarily an invertivorous receptor; it was used as a surrogate for herbivorous mallards to maximize exposure to potential Hanford Site aquatic COPCs. Hazard indices for bufflehead (Figures 6-50a and 6-50b) are elevated above one but are not significantly different between near-shore operational and reference areas (Student's t test, α=0.05).

Occult myotis bat HQs are based on comparing COPC exposure from water and diet (water ingestion and 100% benthic macroinvertebrate diet [assumed to be emergent aquatic insects]; Appendix H, Section H-1) to COPC-specific TRVs for mammals (Appendix H, Section H-3). Hazard indices for bats (Figures 6-51a and 6-51b) are summed HQs and are elevated above one. The COPCs primarily contributing to elevated HIs include strontium, selenium, copper, and antimony (Appendix H, Section H-4, occult myotis bat). With the exception of strontium, these analytes are not associated with Hanford Site operations (Section 4.0). Also, as a point of comparison the concentrations of antimony and selenium for kingbird carcass and crops is similar between operational area and reference site samples. Hazard indices were significantly higher in near-shore operational areas relative to reference sites (Student's t test, α=0.05, $p<0.0001$), indicating greater contaminant uptake into invertebrate prey in operational areas. A broader scale assessment of bats including the Inter-Areas shoreline assessment is warranted to address conservatism in the home range used in this assessment. It is also important to better understand the sources of the COPCs contributing to risk to bats.

Great blue heron HQs are based on comparing COPC exposure from sediment and diet (water ingestion and 94% fish and 6% benthic macroinvertebrate diet; Appendix H, Section H-1) to COPC-specific TRVs for birds (Section H-3). Hazard indices for herons (Figures 6-52a and 6-52b) are based on summed HQs and are elevated above one and are significantly different between near-shore operational and reference areas (Student's t test, α=0.05). HIs are much higher in reference areas due to reporting nondetected PCBs in fish tissue at half the detection limit (Appendix H, Section H-4, Great Blue heron).

Hazard indices for hawks consuming surface water and birds are presented in Figures 6-53a and 6-53b. Hazard indices for red-tailed hawks are below one, suggesting low potential for risk. In addition, HIs are not statistically significantly different when comparing the near-shore operational and reference sites (Student's t test, α=0.05).

Hazard indices for badgers drinking river water (Figures 6-54a and 6-54b) are summed HQs and are elevated above one but are not significantly different between near-shore operational sites and reference sites (Student's t test, α=0.05).

Literature values for survival, growth, and reproduction compared to measured exposure

COPCs in whole fish are compared to the threshold for tissue effects based on literature data. In the figures presented in Appendix H-6, data are plotted against Hanford River mile. Aquatic tissue effects levels are found in the Appendix H-6, Section H-6. As shown in Figures H-6-2-1 through H-6-2-6, detected whole fish silver concentrations were greater than its no-effect level at one location near the 100-N Area, and selenium was greater than its no-effect concentrations at all sample locations (upstream and operational).

COPCs in fish livers are compared to the threshold for tissue effects based on literature data. In the figures presented in Appendix H-6, data are plotted Hanford River mile. Fish liver tissue effects levels are found in Appendix H-6, Section H-6. As shown in Figures H-6-3-1 through H-6-3-5, cadmium in fish livers was greater than its effect concentration at a variety of upstream and operational locations, and total chromium was also greater than its liver effect concentration at many locations (both upstream and operational). Nickel is greater than its liver-effect concentration at one upstream location, and selenium is greater than its liver-effect concentration at two operational locations.

Fish histopathology

Descriptions of fish morphology and histopathology measurement and the contingency tables detailing the number of observations per score versus expected occurrence are provided in Appendix H, Section H-8. Fish did not differ in gross morphological attributes; fish length (Figure 6-55a) and fish weight (Figure 6-55b) were similar between operational and reference areas. Statistically significant differences between operational and reference site fish were observed for six histopathological measurements (Table 6-7): three histopathological attributes were more pronounced in reference area samples and three attributes were more pronounced in operational area samples. Attributes that differed significantly between operational and reference area fish tissue samples, with reference area tissues demonstrating significantly higher scores, included reproductive development score that indicates less developed stages of reproductive development ((Figure 6-55d) (Chi-square = 9.6, p = 0.05), number of encysted gill parasites (Chi-square = 4.6, p = 0.03), and number of encysted kidney parasites (Chi-square = 16.2, p = 4.8E-5). These findings suggest that less reproductively mature fish are found in reference locations and that target organs of heavy metal contamination (gills, kidney) are elevated relative to operational areas.

Histopathological measurements with higher scores in operational area samples included the number of liver granulomas (Chi-square = 6.7, p = 0.01), number of liver parasites (Figure 6-55d) (Chi-square = 16.1, p = 6.1E-6), and the number of muscle granulomas (Chi-square = 12.6, p = 0.0004). No statistical differences were apparent for observed versus expected occurrence of histopathology scores for any of the other 12 remaining measurements (Table 6-7). These findings suggest that the liver (a target organ of heavy metal contamination) in fish associated with operational areas is more impacted than the liver in fish associated with reference areas. However, there were no significant correlations between COPCs in pore water or fish tissue and adverse histopathological measurements having higher frequency of occurrence in operational area fish; only histological impacts associated with fish from reference areas were correlated with fish tissue COPCs (Appendix H, Section H-7).

Summary of Risks to Middle and Upper Trophic-Level Fish, Birds, and Mammals

Fish. There is no clear indication of an impact of COPCs on fish populations in the Hanford Reach. Fish with higher reproductive maturity were more frequent in operational areas relative to reference locations. There are no strong trends in fish histopathological observations between organisms collected at operational and reference site locations; of 18 endpoints, slight adverse effects are associated with three in operational areas and with 3 endpoints in reference areas; no COPCs were correlated with histopathological endpoints associated with adverse effects in operational areas. In general, tissue effects levels were elevated for some metals (or in the case of selenium, all locations) at a few operational and reference site locations. In addition, evidence of greater contaminant uptake in fish from operational areas was not apparent.

Birds. Exposure to birds modeled to consume emergent insects (kingbirds), a combination of emergent insects and sessile invertebrates (buffleheads), or primarily fish (Great Blue heron) was not higher at operational sites versus reference site locations.

Bats. Hazard indices for bats were significantly higher in operational areas relative to reference sites, indicating potential risk to bats based on modeling consumption of benthic macroinvertebrates. The COPCs that contributed to the bat hazard index were antimony and selenium, which are not key groundwater plume contaminants. A broader scale assessment of bats including the Inter-Areas shoreline assessment is warranted to address conservatism in the home range used in this assessment. It is also important to better understand the sources of the COPCs contributing to risk to bats.

Summary of Aquatic Lines of Evidence

Each aquatic LOE is linked to the aquatic risk question serving as the basis for each measure, and the measure's risk conclusions are summarized in Table 6-8.

6.5 UNCERTAINTIES

Limitations associated with the risk assessment data and methodologies for the terrestrial and aquatic environments are presented for each LOE and summarized qualitatively in Tables 6-9 and 6-10, respectively. Known uncertainties and data gaps associated with the screening and focused risk evaluations are summarized, and their implications for estimating potential adverse effects and conclusions are noted. The qualitative uncertainty analysis identifies specific causes of uncertainties and evaluates their potential impact on risk estimates. Specific sources and effects of the uncertainty factor on the resulting risk estimates for the site (whether the factors tend to over- or underestimate calculated risks) are organized according to assessment endpoint-specific LOEs. Specific uncertainties for each LOE are presented for receptors in terrestrial (Table 6-9) and near-shore (Table 6-10) environments. Some of these uncertainties have been recognized, and supplemental data collection for the 100 Area and 300 Area Component of RCBRA was incorporated into the Inter-Areas shoreline assessment.

6.6 CONCLUSIONS

This ecological risk assessment has evaluated risks to a comprehensive array of assessment endpoints using multiple measures of exposure, effect, and ecosystem/receptor characteristics. For the ecological exposure assessment, we have made some inherently protective assumptions. Based on agreements reached at the regulator/trustee workshops, we have included all COPCs in the assessment and we have evaluated all receptors on a site-specific basis. The objective of this assessment is to provide information to support the RI report and ultimately the final ROD. As demonstrated in this assessment, including COPCs with no connection to Hanford Site waste sites might be counter to the type of information that is most useful for remedial site decision making.

The assessment does provide information on some near-shore environment operational areas that are worth further consideration in terms of suggesting the potential for ecological risks associated with Hanford Site COPCs:

- Sediments: Macroinvertebrates
- Macroinvertebrates: Bats.

No ecological risks were associated with Hanford Site COPCs at upland remediated waste sites and riparian operational area soils.

Figure 6-1a. Radionuclide Sum of Fractions for Upland Plants Grouped by Site Category.

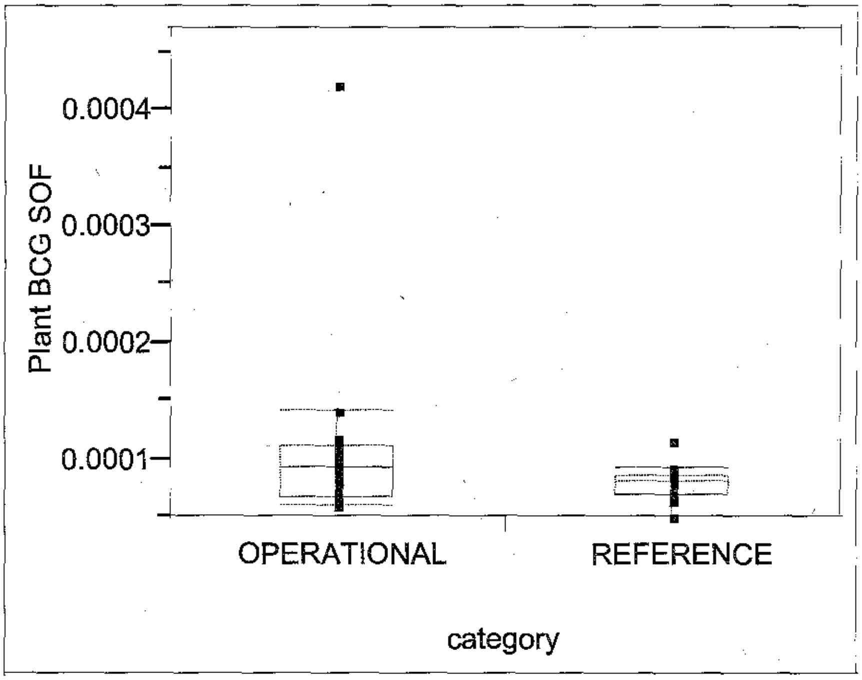


Figure 6-1b. Radionuclide Sum of Fractions for Upland Plants Grouped by Individual Sites.

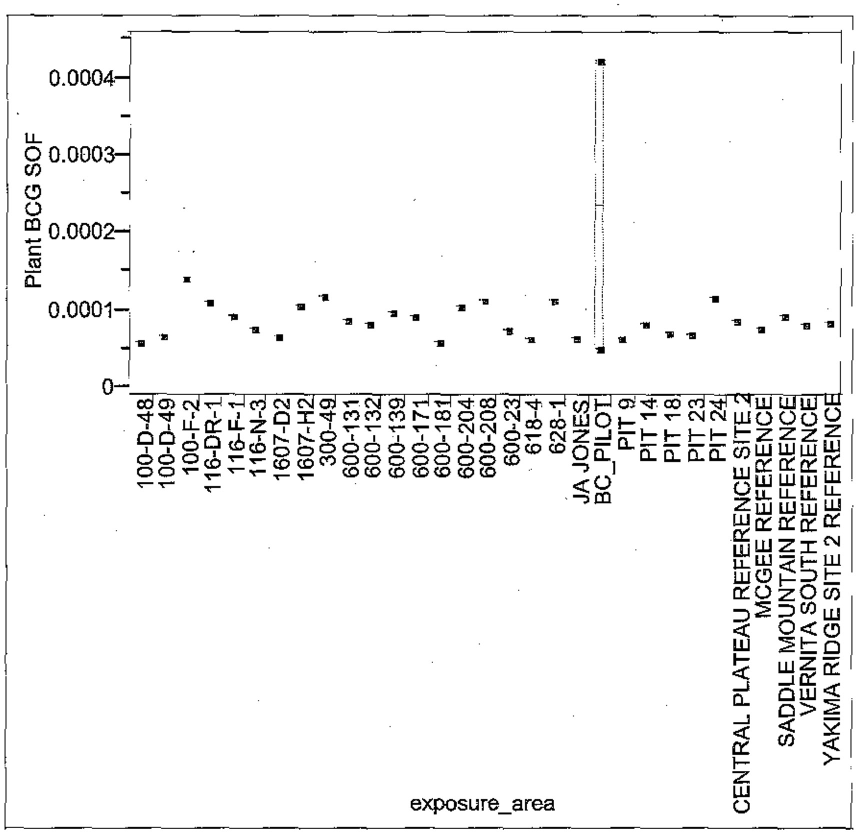


Figure 6-1c. Hazard Indices for Upland Plants Grouped by Site Category.

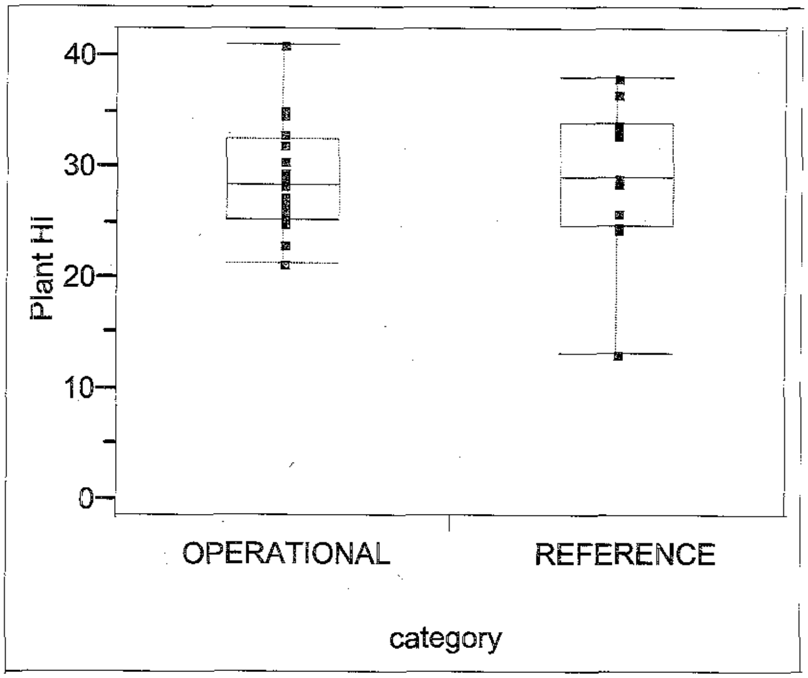


Figure 6-1d. Hazard Indices for Upland Plants Grouped by Individual Sites.

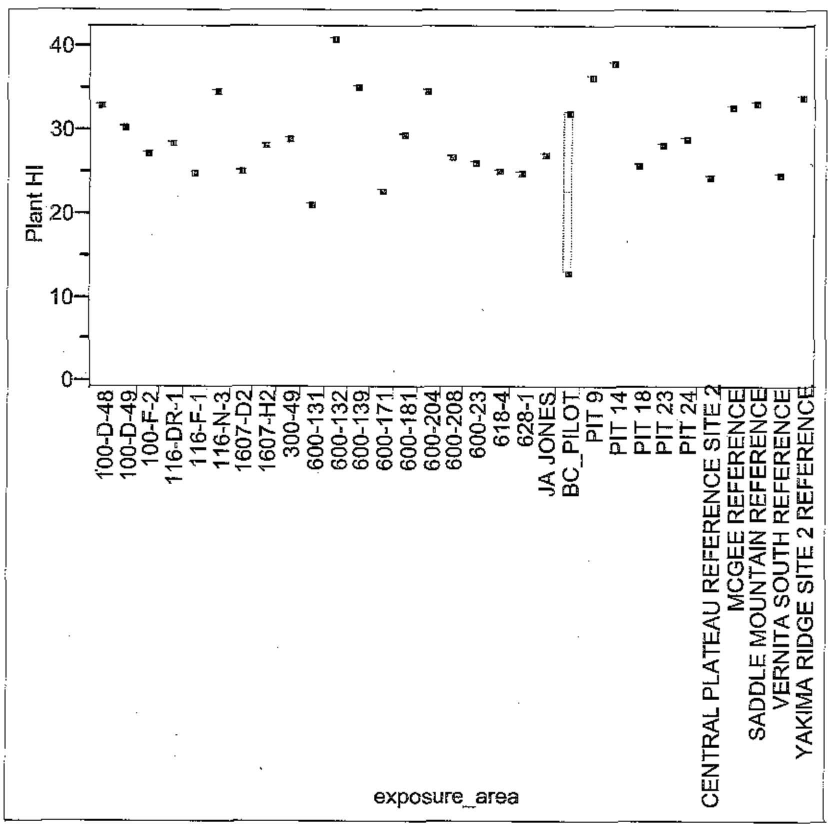
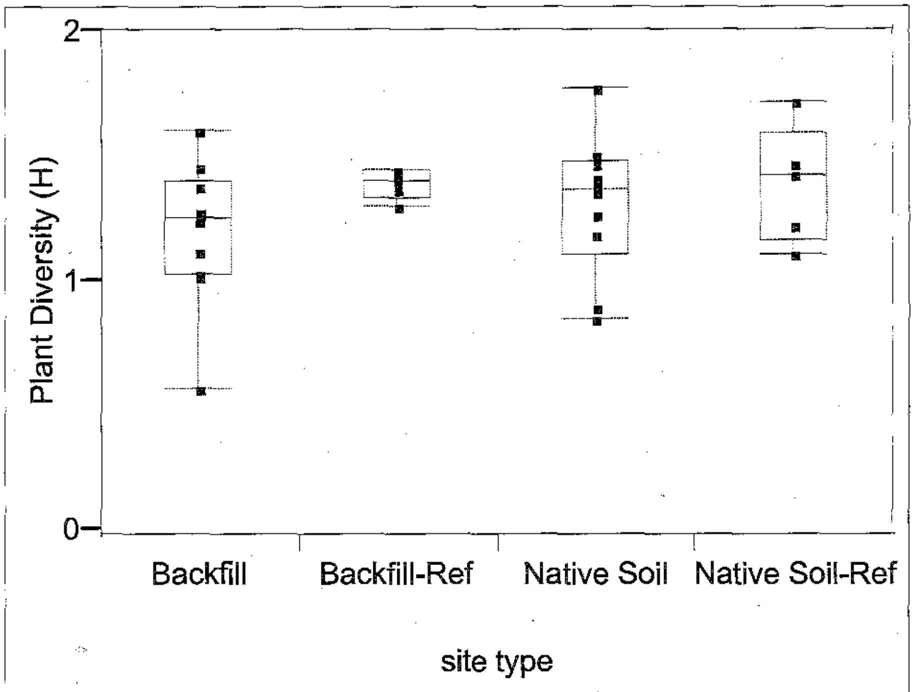
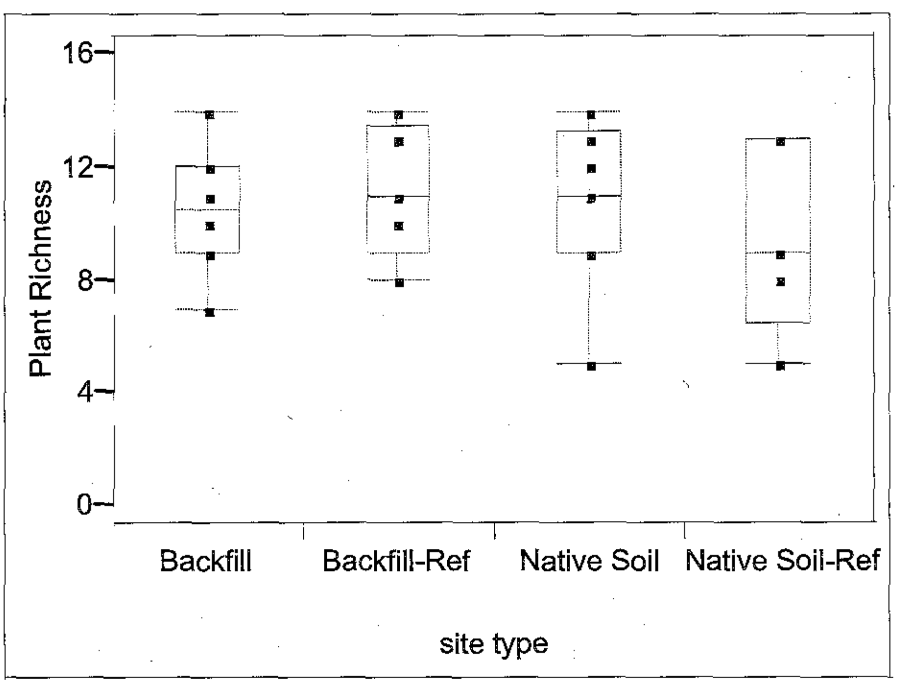


Figure 6-2a. Plant Diversity at Hanford Terrestrial Upland Sites.



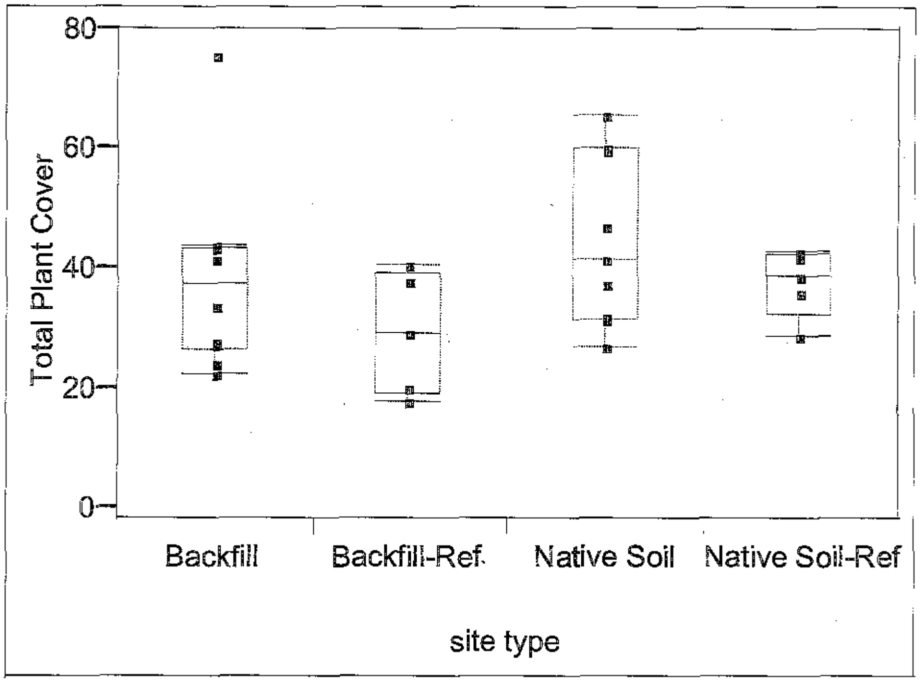
The terrestrial upland environment is represented by remediated backfill and remediated backfill reference sites and remediated native soil and native soil reference sites.

Figure 6-2b. Plant Richness at Hanford Terrestrial Upland Sites.



The terrestrial upland environment is represented by remediated backfill and remediated backfill reference sites and remediated native soil and native soil reference sites.

Figure 6-2c. Plant Total Cover at the Hanford Terrestrial Upland Sites.



The terrestrial upland environment is represented by remediated backfill and remediated backfill reference sites and remediated native soil and native soil reference sites.

Figure 6-3a. Hazard Indices for Upland Soil Invertebrates Grouped by Site Category.

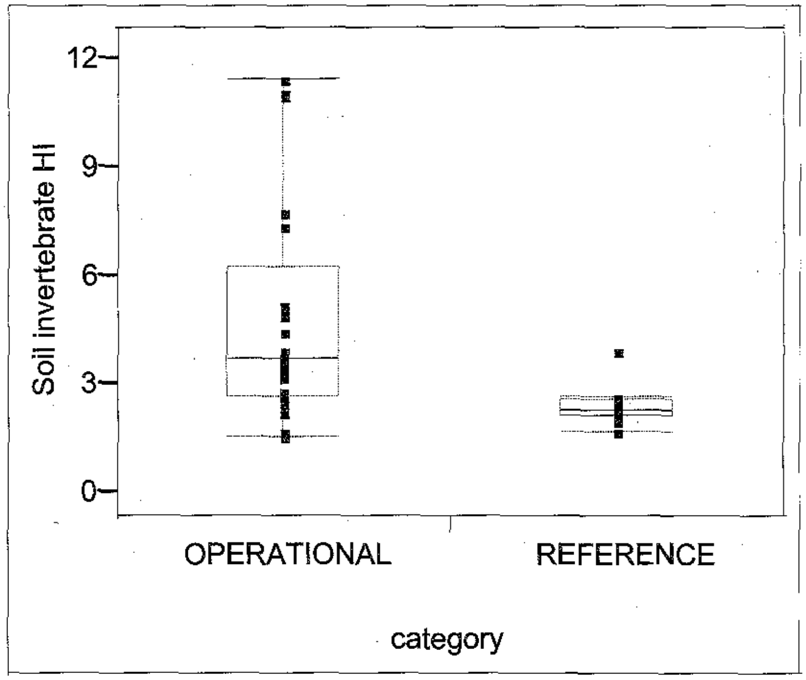


Figure 6-3b. Hazard Indices for Upland Soil Invertebrates Grouped by Individual Sites.

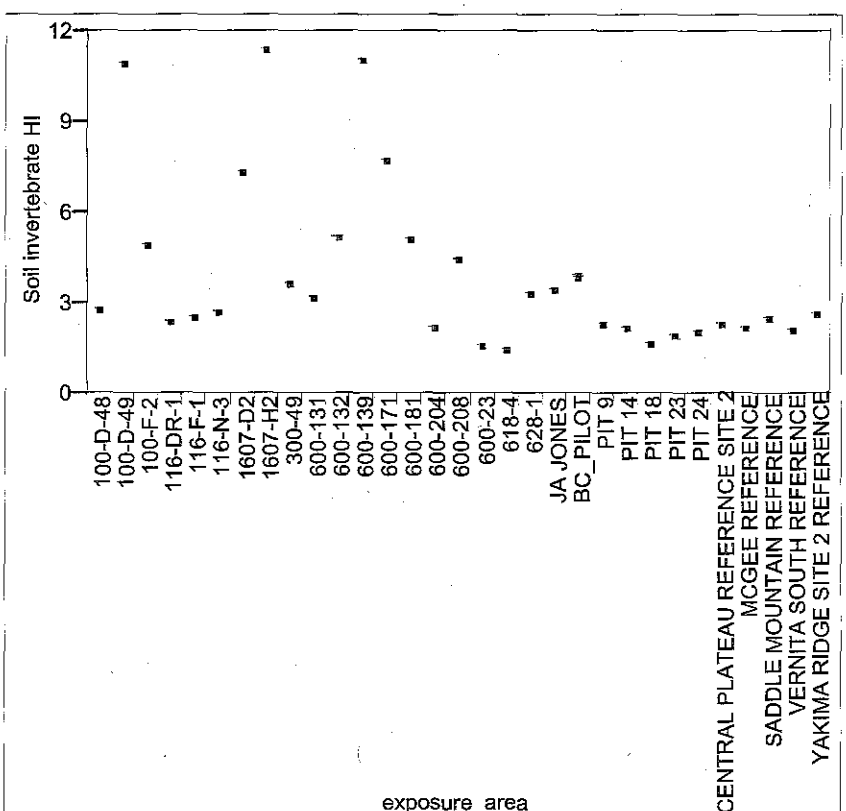
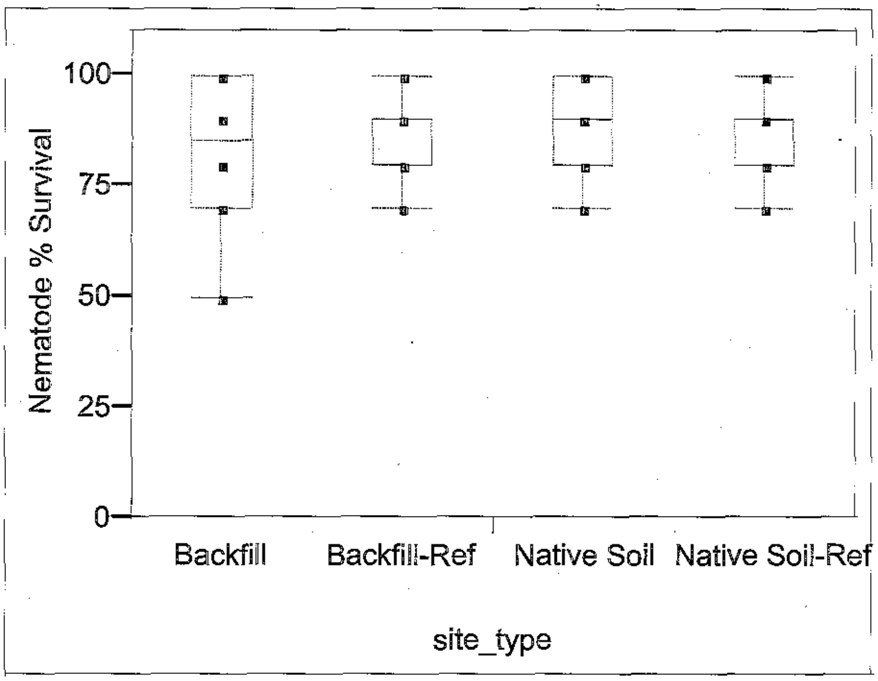


Figure 6-4. Nematode Survival at Hanford Terrestrial Upland Sites.



The terrestrial upland environment is represented by remediated backfill and remediated backfill reference sites and remediated native soil and native soil reference sites.

Figure 6-5a. Radionuclide Sum of Fractions for Upland Wildlife Grouped by Site Category.

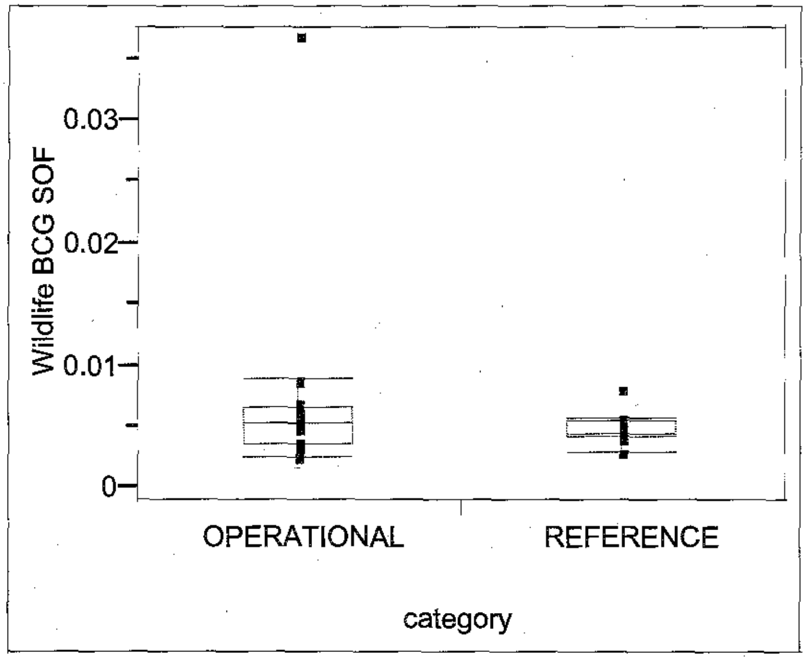


Figure 6-5b. Radionuclide Sum of Fractions for Upland Wildlife Grouped by Site Category.

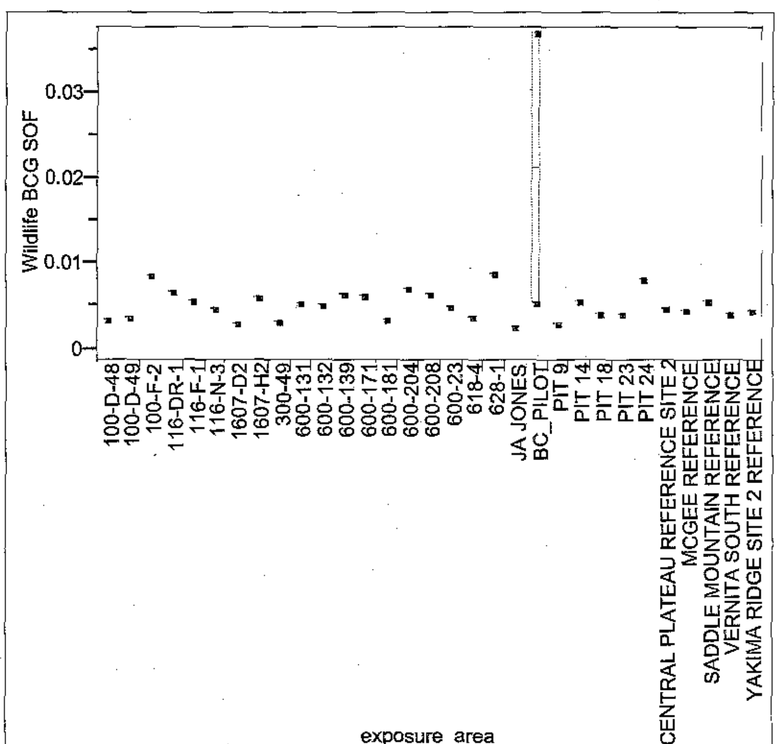


Figure 6-6a. Hazard Indices for Upland Mourning Dove Grouped by Site Category.

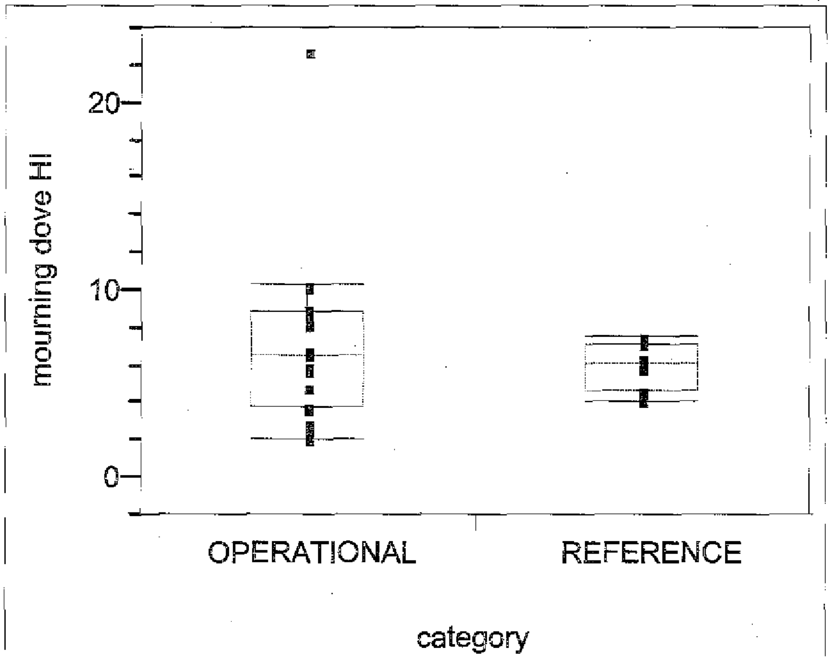


Figure 6-6b. Hazard Indices for Upland Mourning Dove Grouped by Individual Sites.

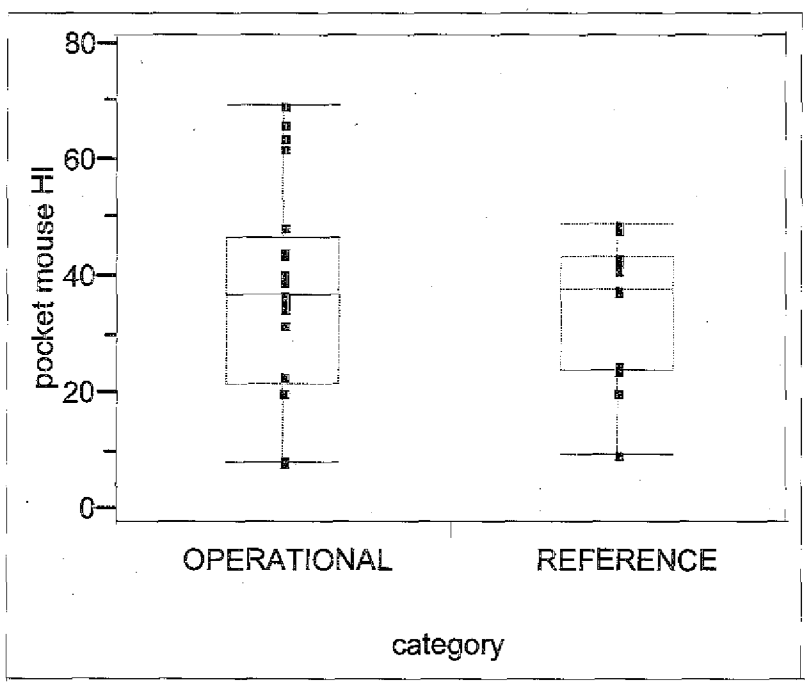


Figure 6-7a. Hazard Indices for Upland Pocket Mouse Grouped by Site Category.

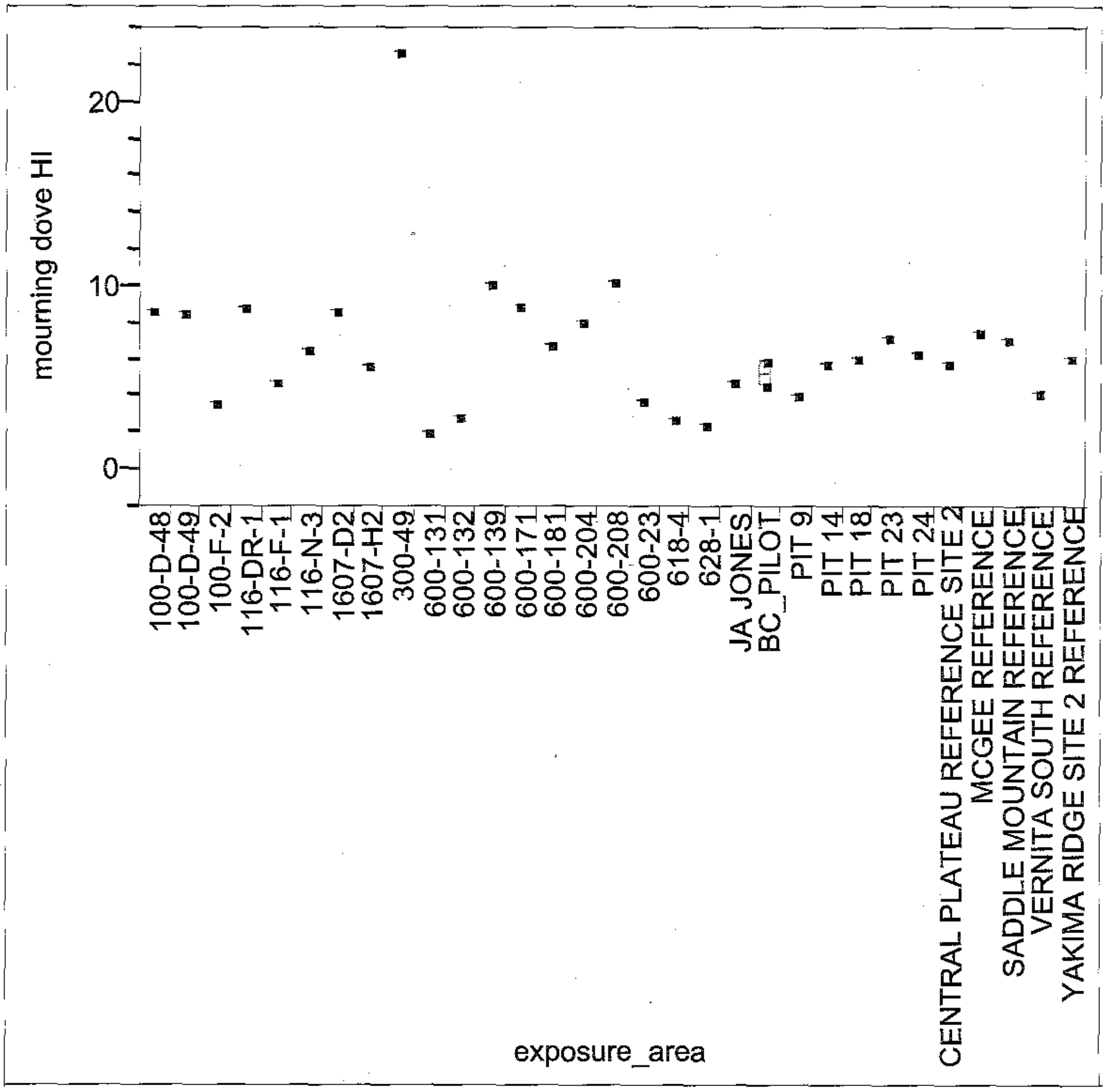


Figure 6-7b. Hazard Indices for Upland Pocket Mouse Grouped by Individual Sites.

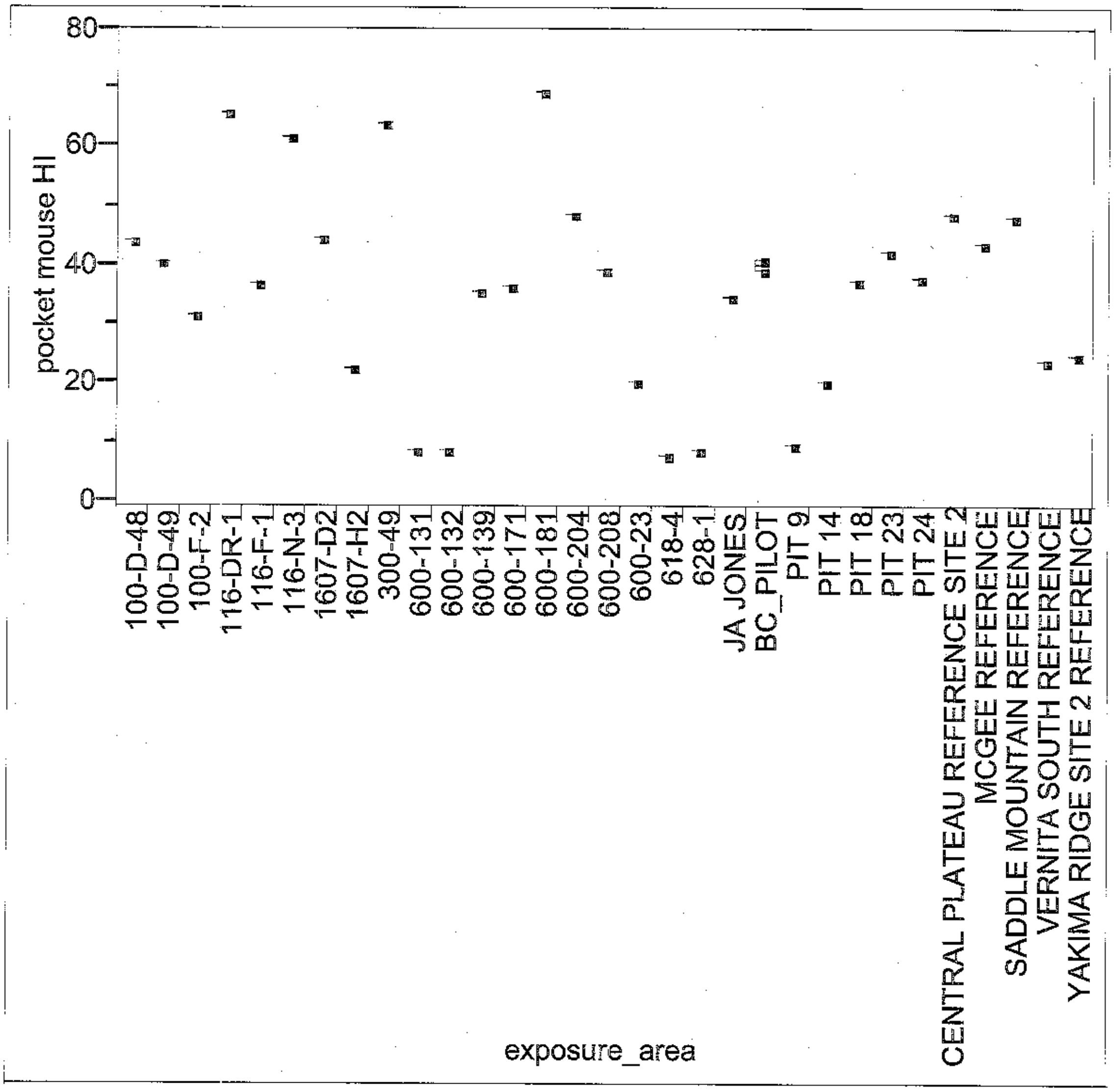


Figure 6-8a. Hazard Indices for Upland Meadowlark Grouped by Site Category.

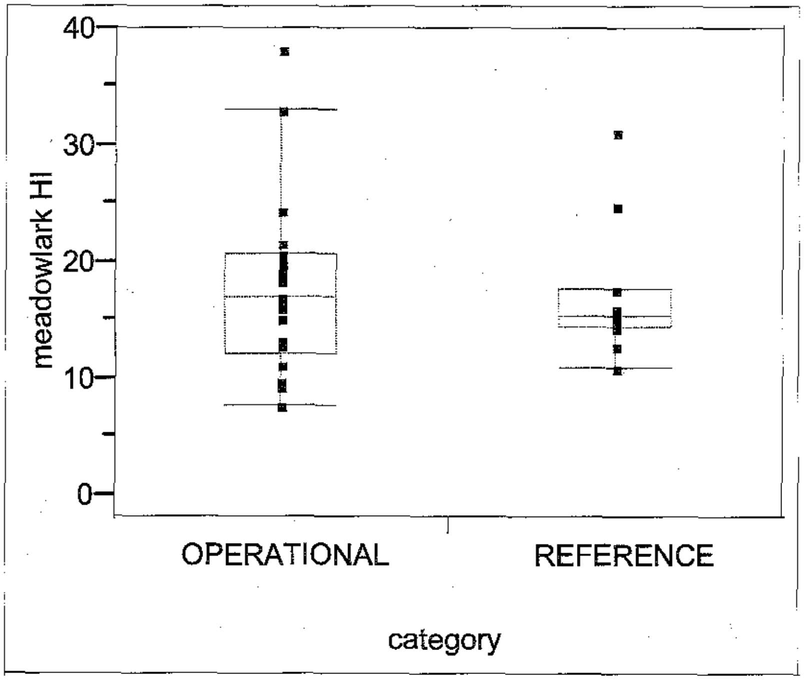


Figure 6-8b. Hazard Indices for Upland Meadowlark Grouped by Individual Sites.

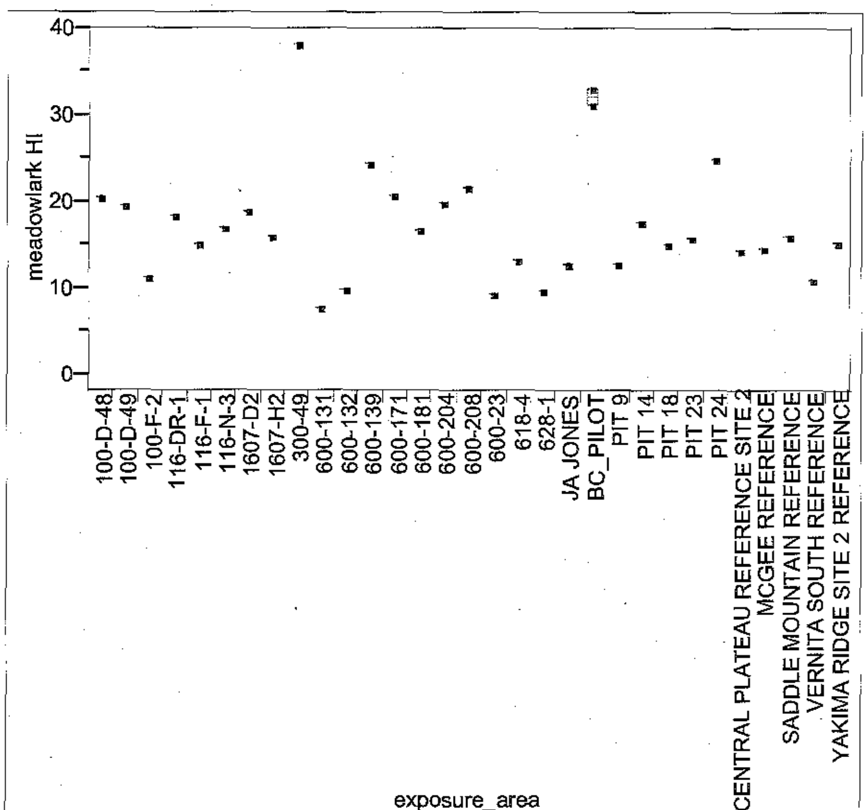


Figure 6-9a. Hazard Indices for Upland Deer Mouse Grouped by Site Category.

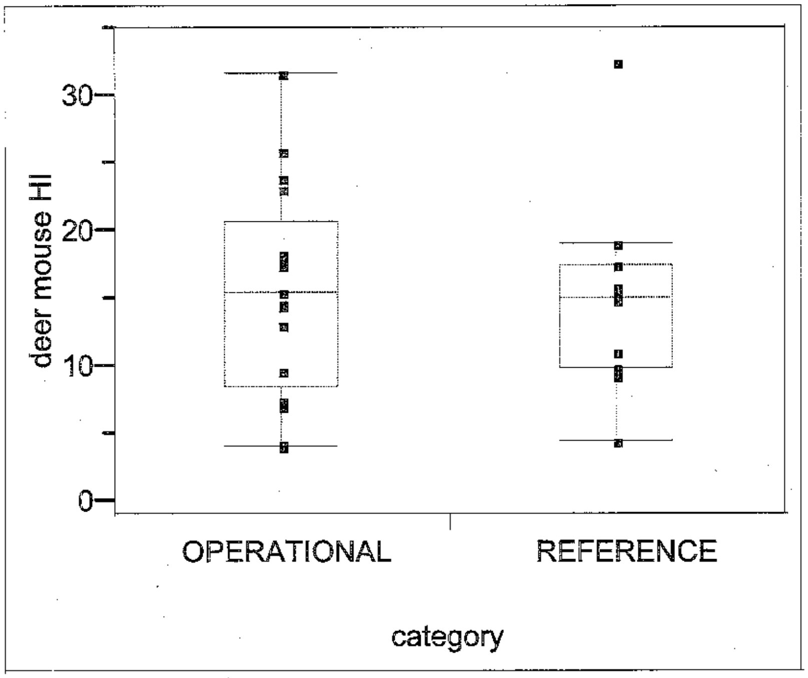


Figure 6-9b. Hazard Indices for Upland Deer Mouse Grouped by Individual Sites.

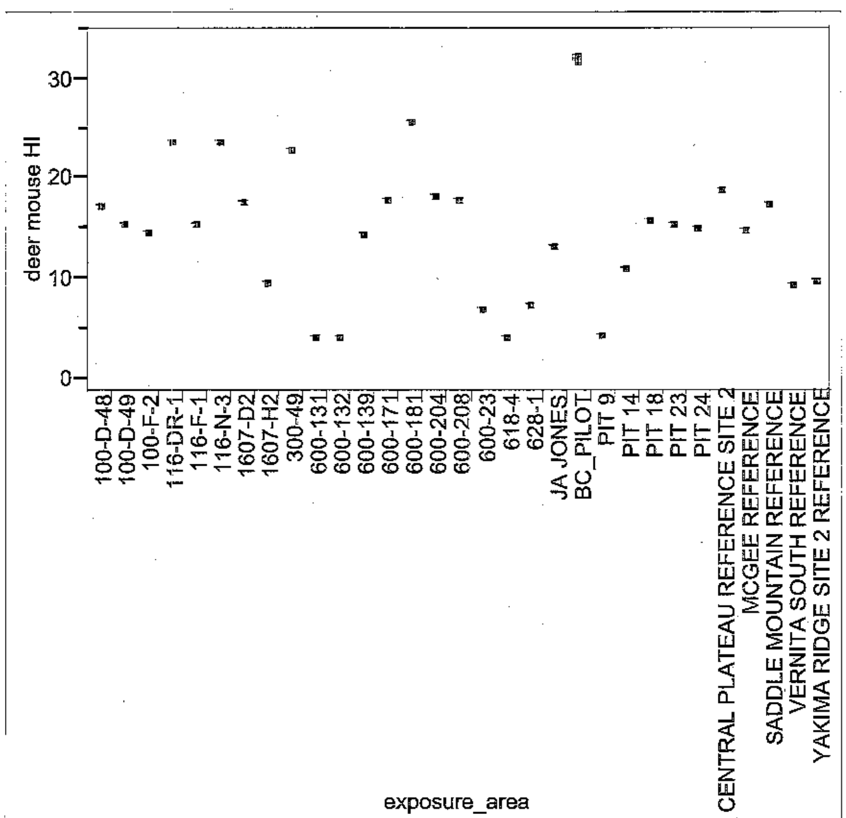


Figure 6-10a. Hazard Indices for Upland Killdeer Grouped by Site Category.

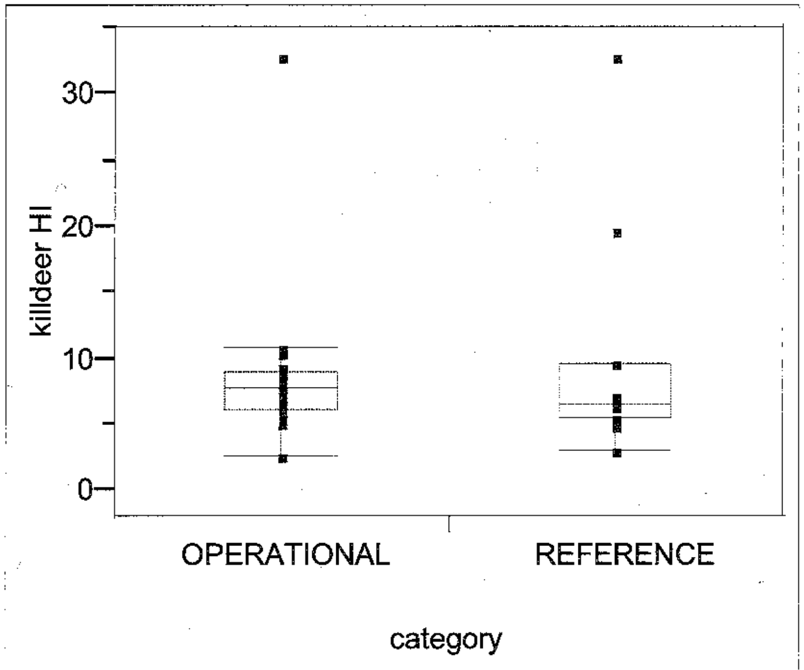


Figure 6-10b. Hazard Indices for Upland Killdeer Grouped by Individual Sites.

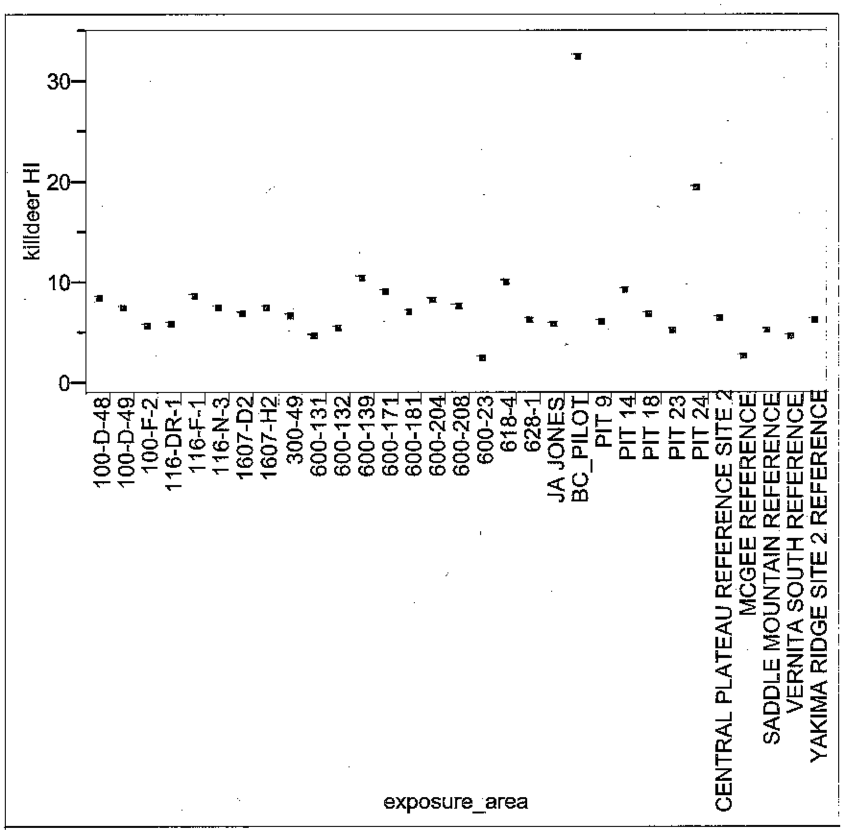


Figure 6-11a. Hazard Indices for Upland Grasshopper Mouse Grouped by Site Category.

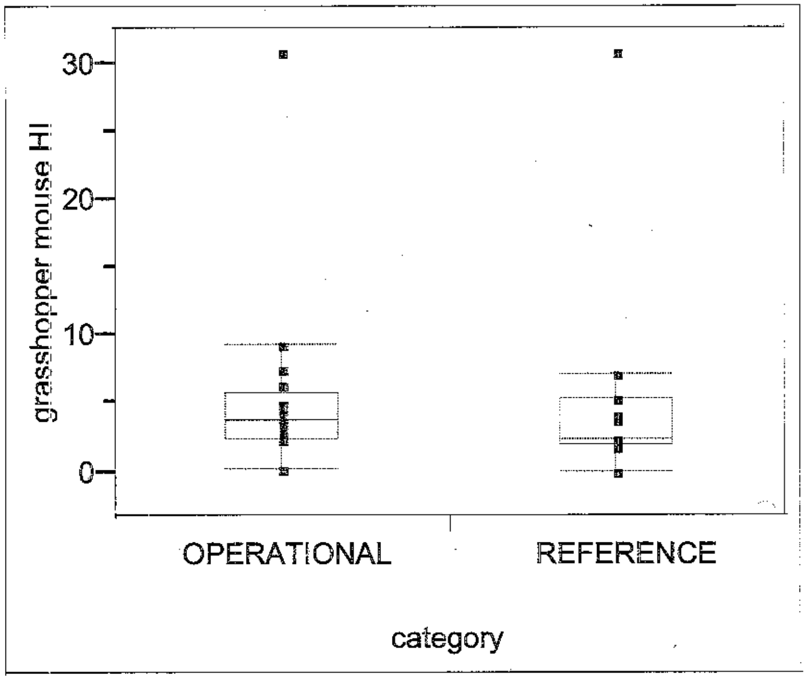


Figure 6-11b. Hazard Indices for Upland Grasshopper Mouse Grouped by Individual Sites.

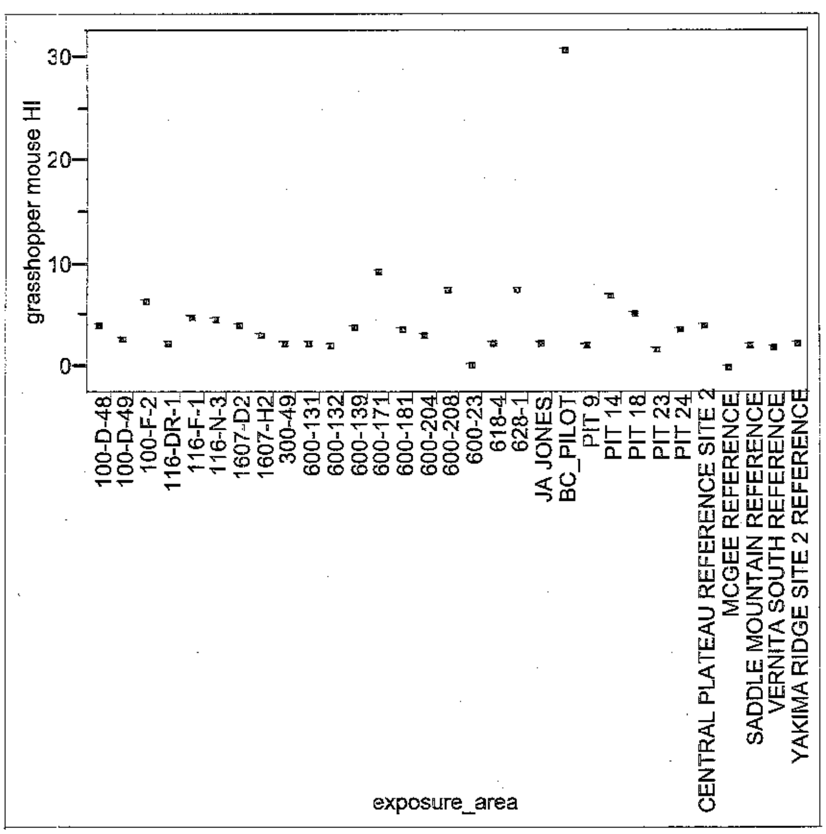
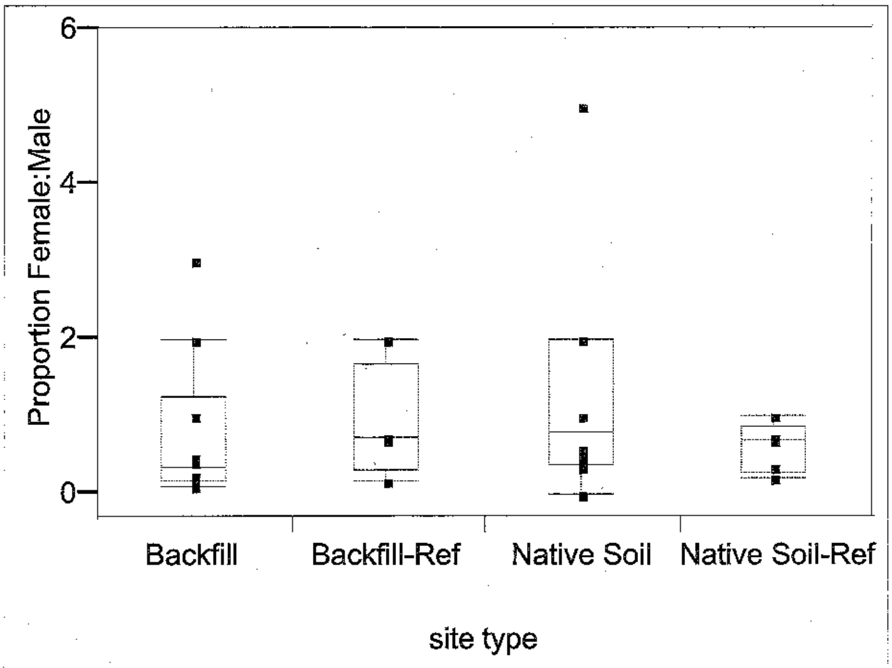
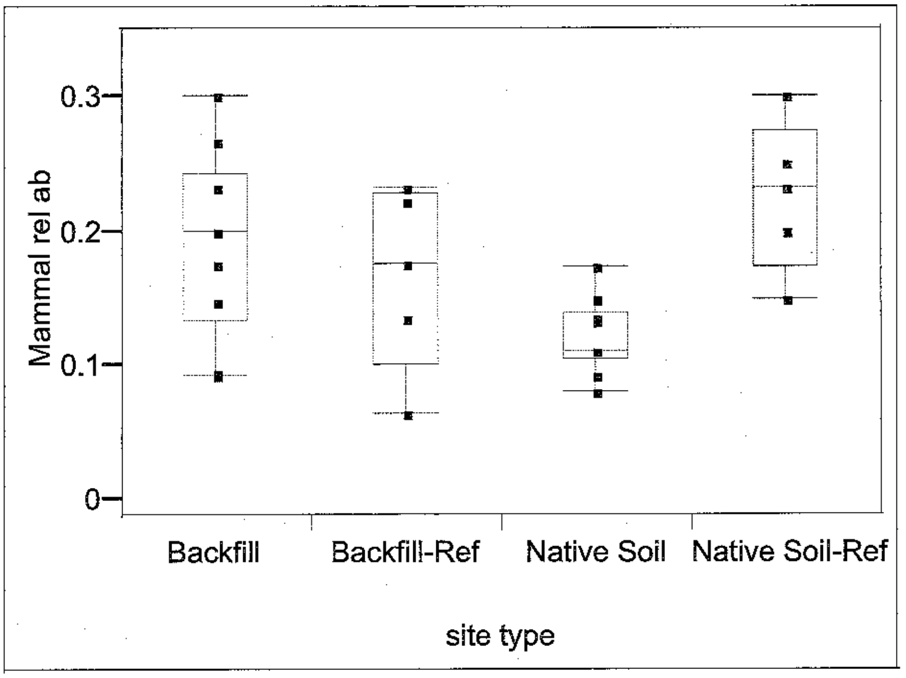


Figure 6-12a. Proportion Female:Male Small Mammals at Hanford Site Terrestrial Upland Sites.



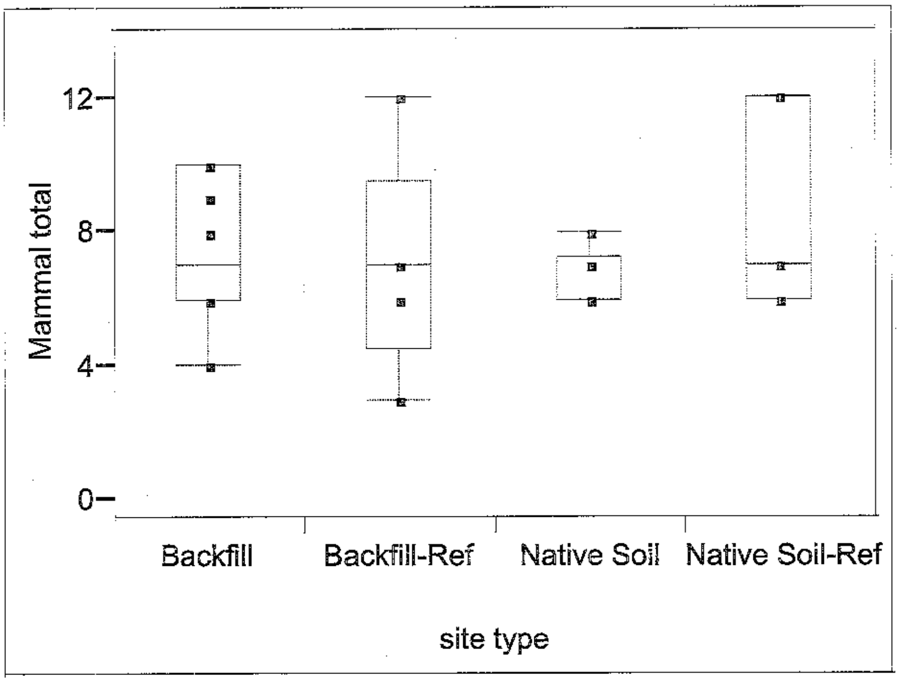
The terrestrial upland environment is represented by remediated backfill and remediated backfill reference sites and remediated native soil and native soil reference sites.

Figure 6-12b. Small Mammal Relative Abundance at Hanford Site Terrestrial Upland Sites.



The terrestrial upland environment is represented by remediated backfill and remediated backfill reference sites and remediated native soil and native soil reference sites.

Figure 6-12c. Total Small Mammals at Hanford Terrestrial Upland Sites.



The terrestrial upland environment is represented by remediated backfill and remediated backfill reference sites and remediated native soil and native soil reference sites.

Figure 6-13a. Hazard Indices for Upland Badger Grouped by Site Category.

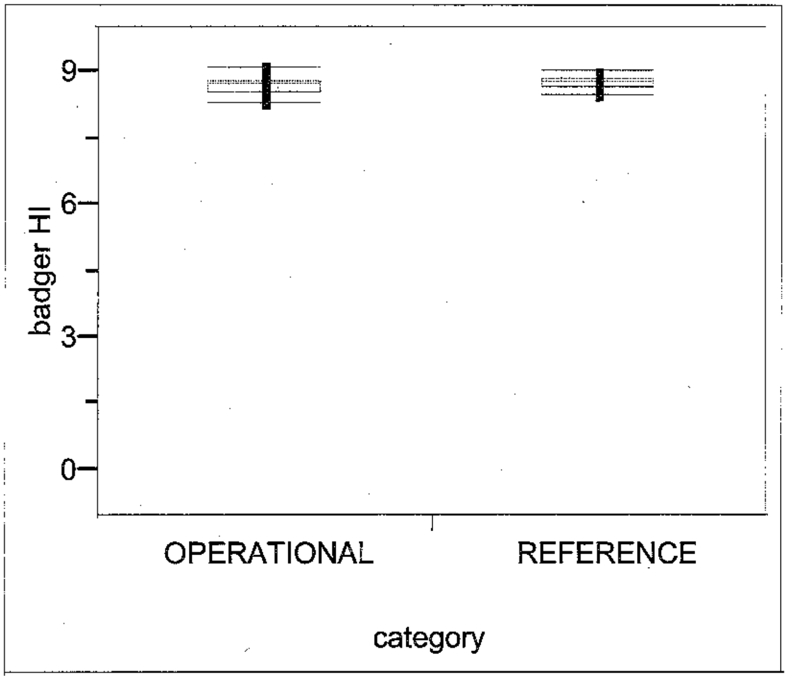


Figure 6-13b. Hazard Indices for Upland Badger Grouped by Individual Sites.

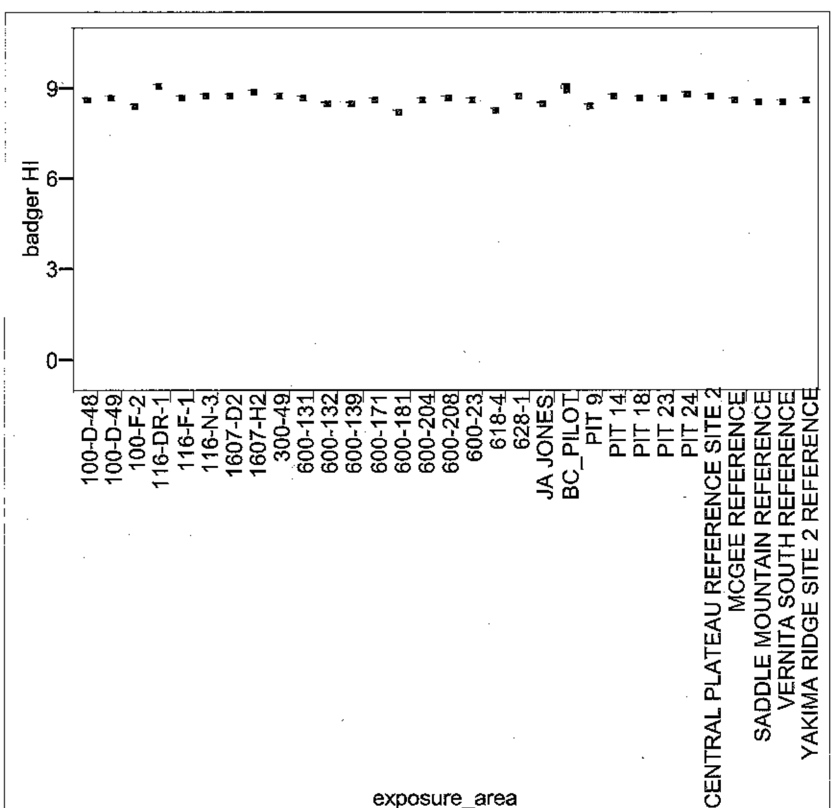


Figure 6-14a. Hazard Indices for Upland Red-Tailed Hawk Grouped by Site Category.

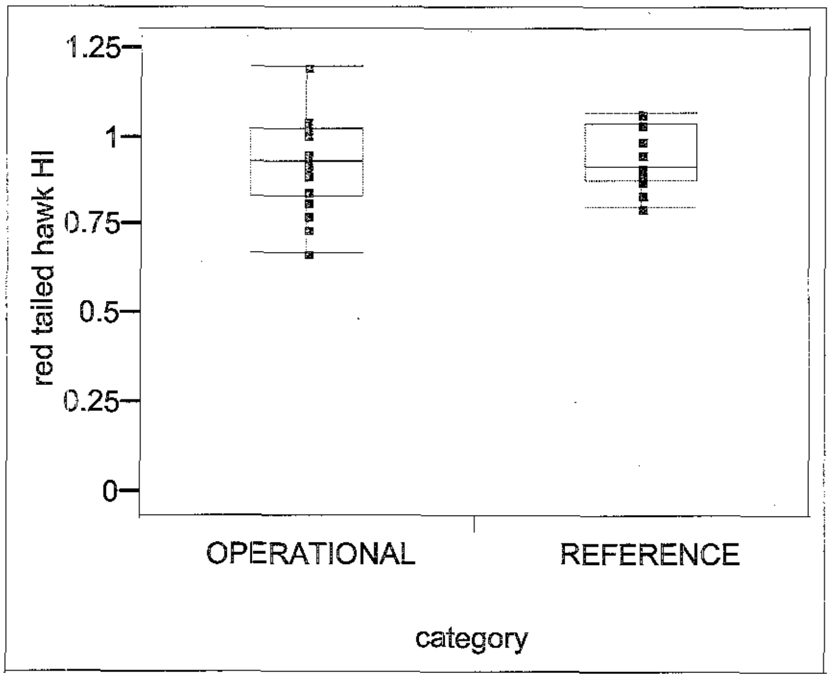


Figure 6-14b. Hazard Indices for Upland Red-Tailed Hawk Grouped by Individual Sites.

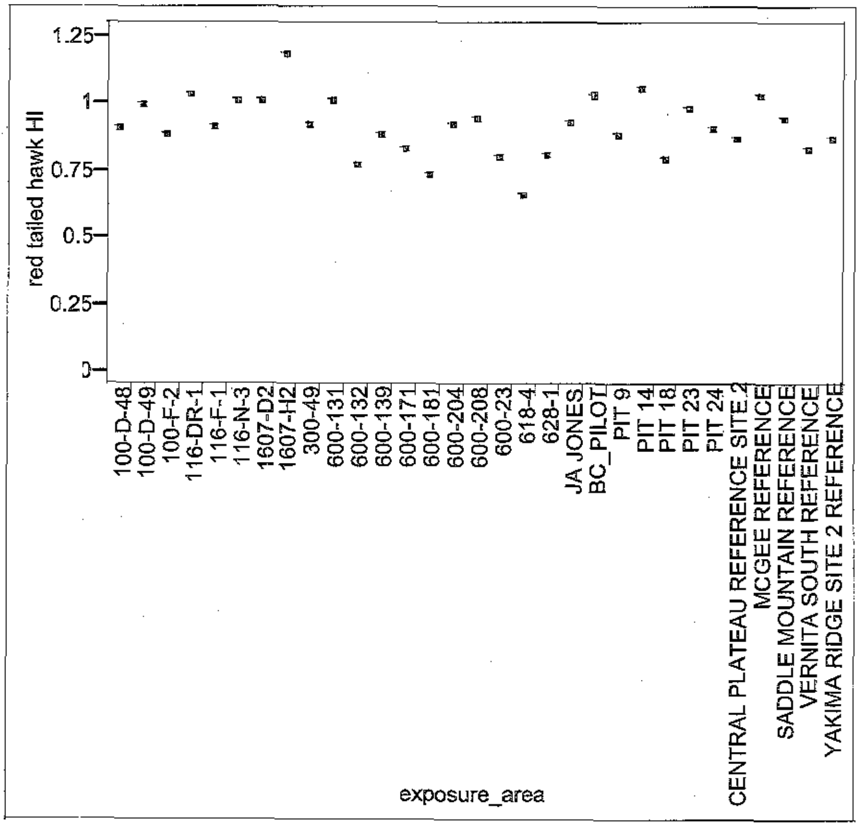


Figure 6-15a. Radionuclide Sum of Fractions for Riparian Plants Grouped by Site Category.

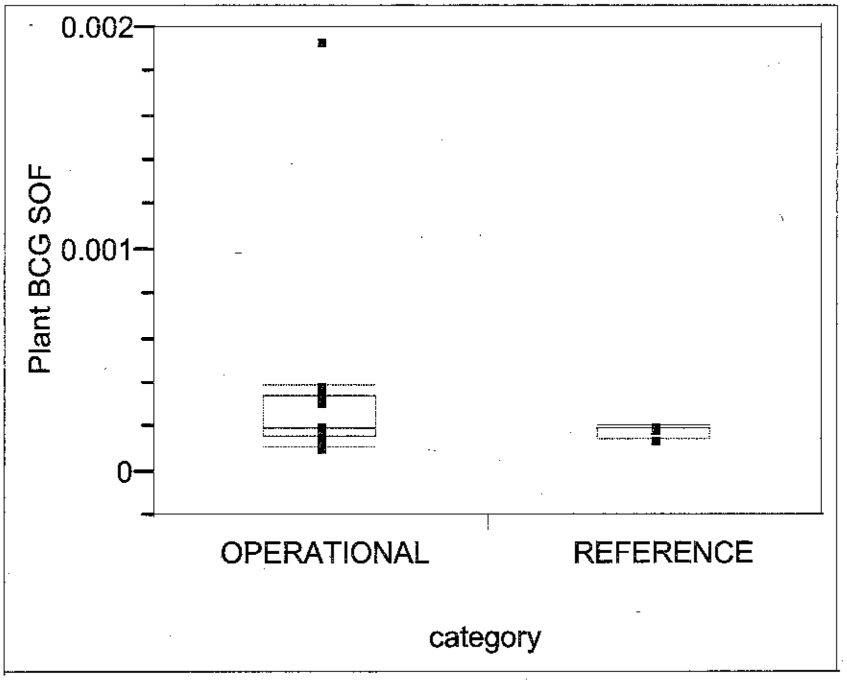


Figure 6-15b. Radionuclide Sum of Fractions for Riparian Plants Grouped by Individual Sites.

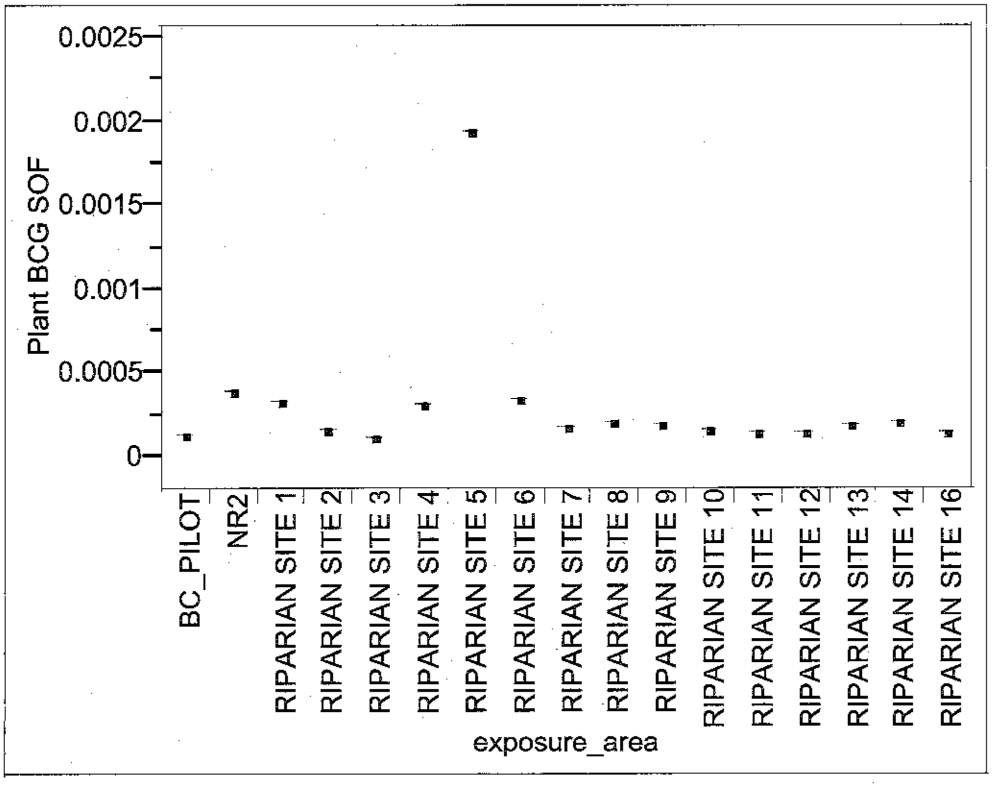


Figure 6-15c. Hazard Indices for Riparian Plants Grouped by Site Category.

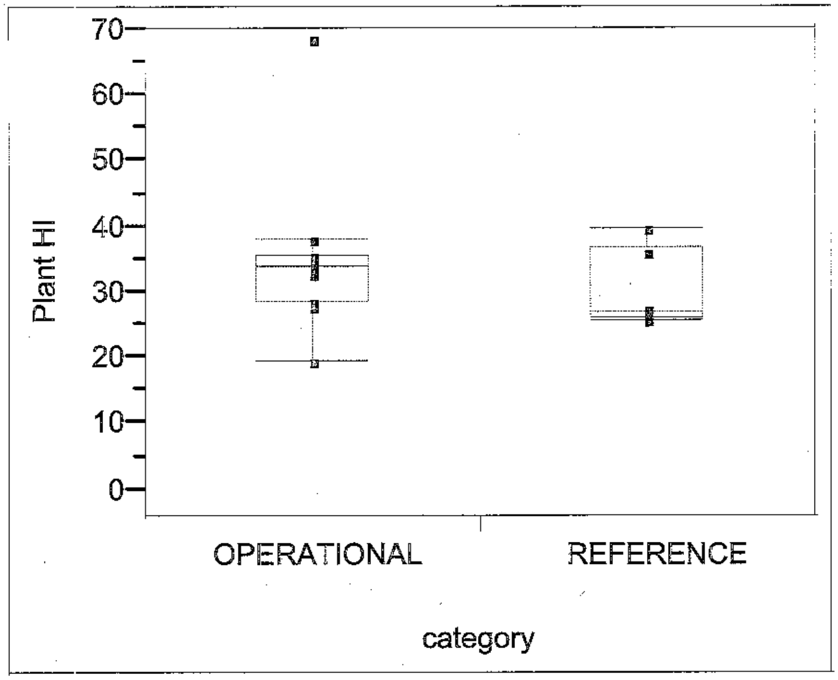


Figure 6-15d. Hazard Indices for Riparian Plants Grouped by Individual Sites.

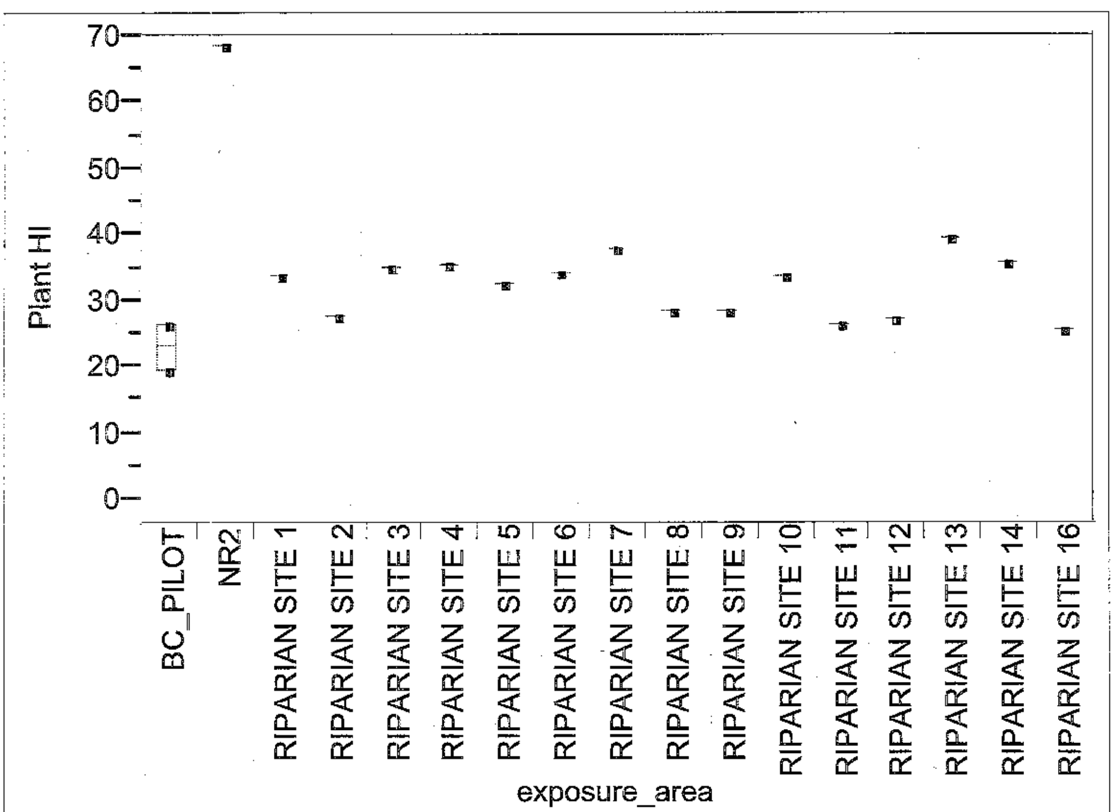


Figure 6-16a. Plant Diversity at Hanford Site Terrestrial Riparian Sites.

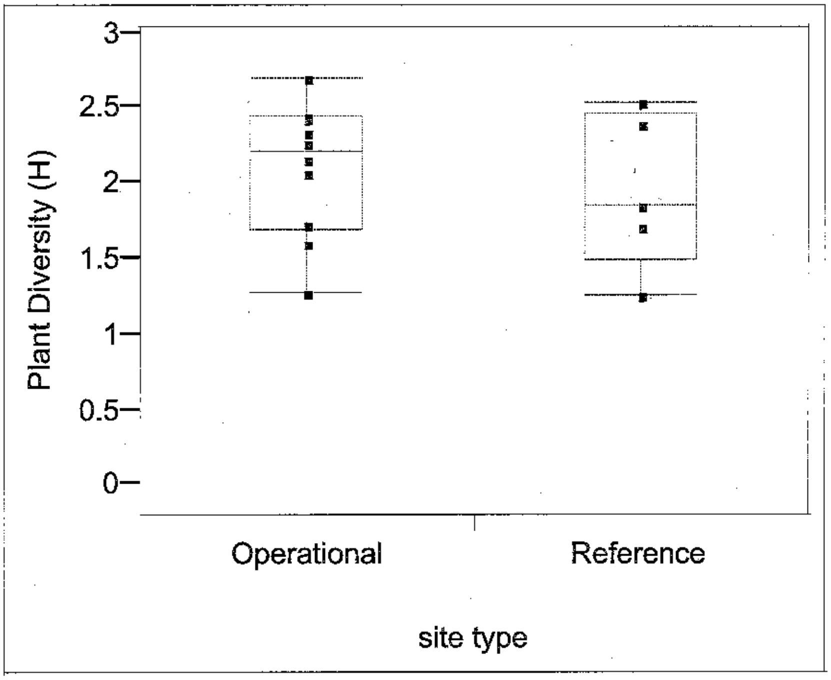


Figure 6-16b. Plant Richness at Hanford Site Terrestrial Riparian Sites.

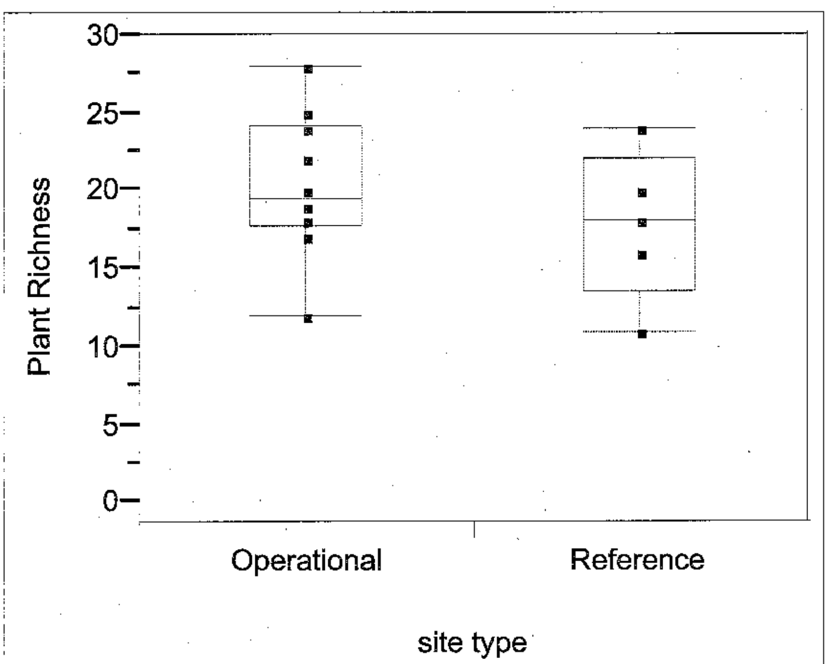


Figure 6-16c. Plant Total Cover at Hanford Terrestrial Riparian Sites.

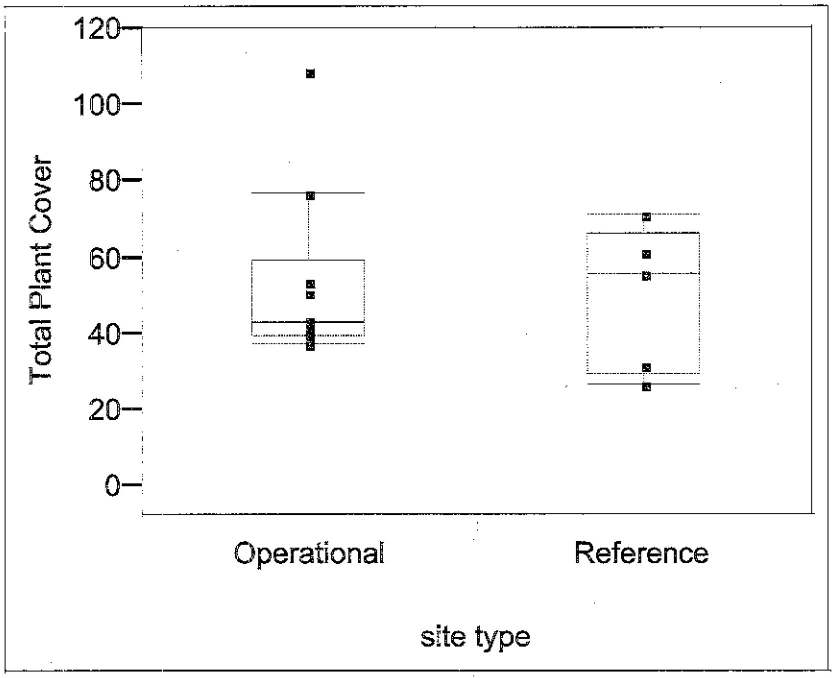


Figure 6-17a. Hazard Indices for Riparian Soil Invertebrates Grouped by Site Category.

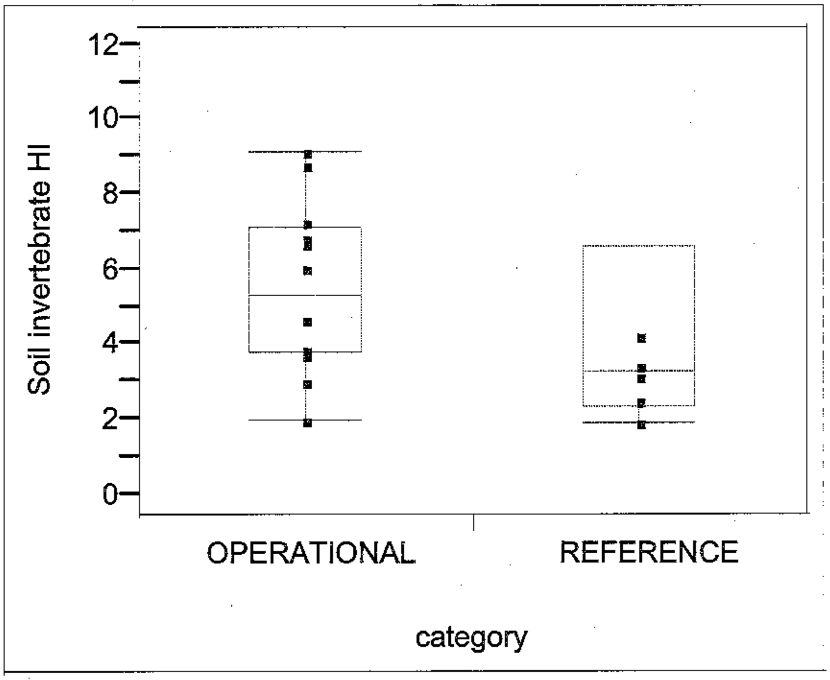


Figure 6-17b. Hazard Indices for Riparian Soil Invertebrates Grouped by Individual Sites.

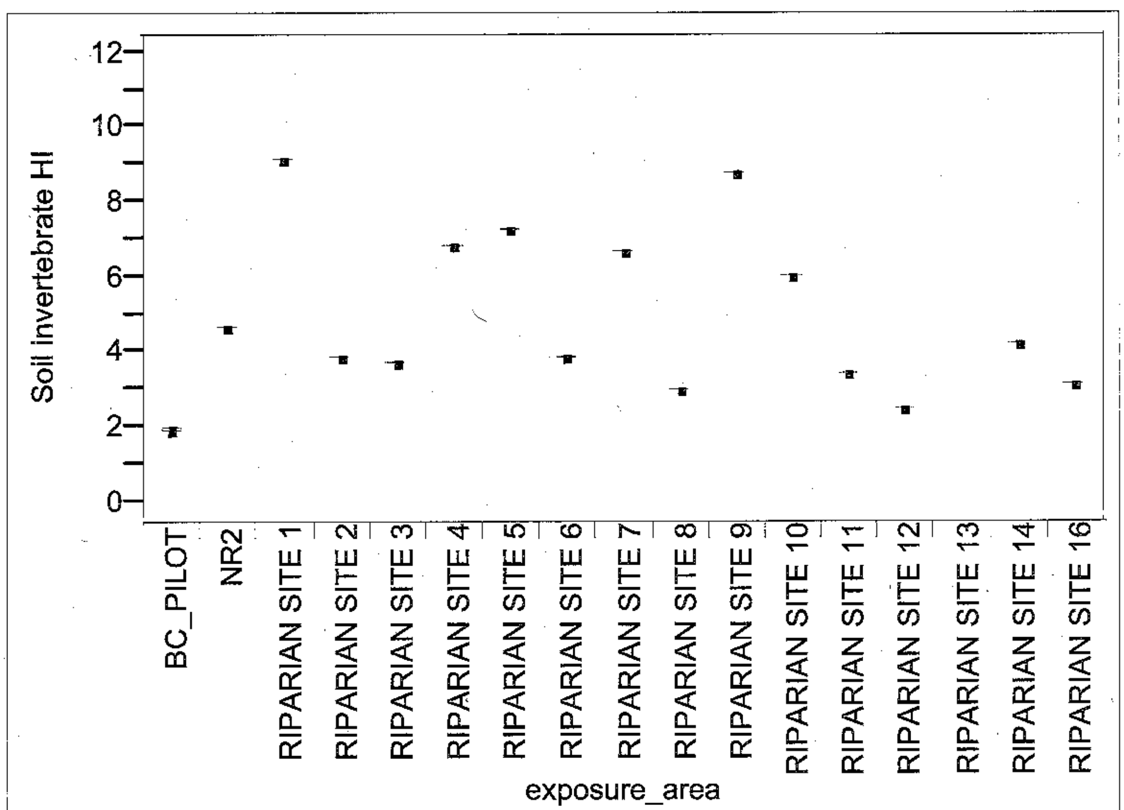


Figure 6-18a. Nematode Survival at Hanford Terrestrial Riparian Sites.

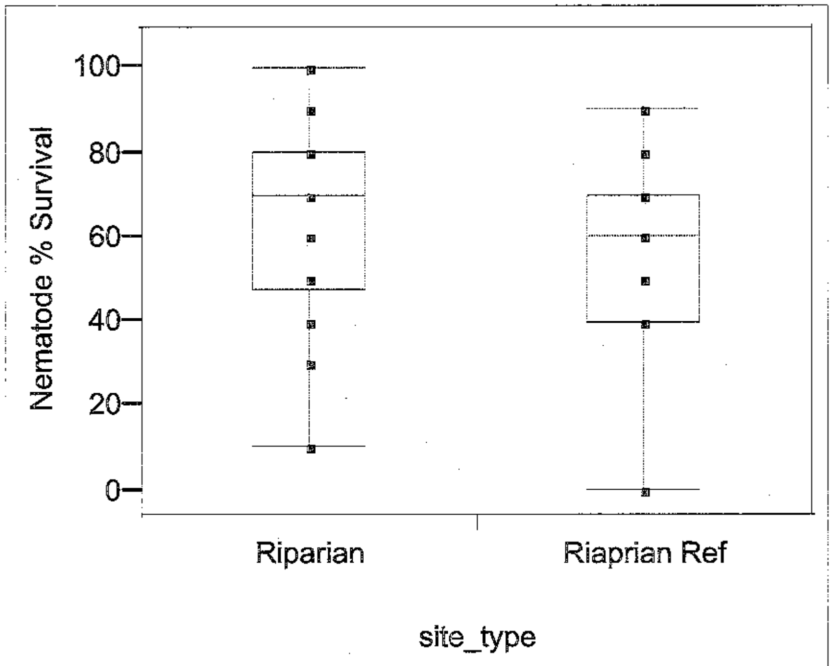
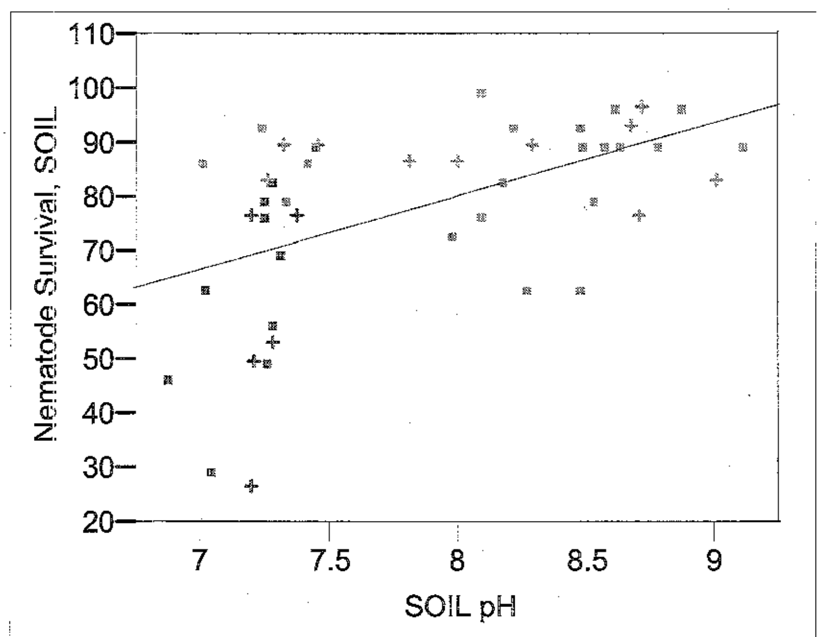


Figure 6-18b. Nematode Survival at Hanford Terrestrial Sites.



Symbols in red represent data from riparian soils and green represents upland soils; (+) reference sites and (▪)operational/waste site

Figure 6-19a. Radionuclide Sum of Fractions for Riparian Wildlife Grouped by Site Category.

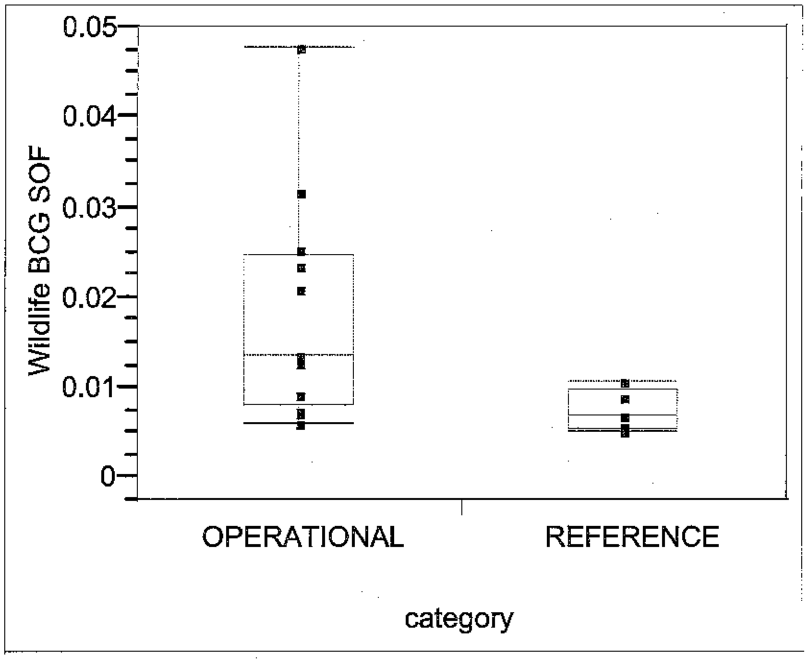


Figure 6-19b. Radionuclide Sum of Fractions for Riparian Wildlife Grouped by Site Category.

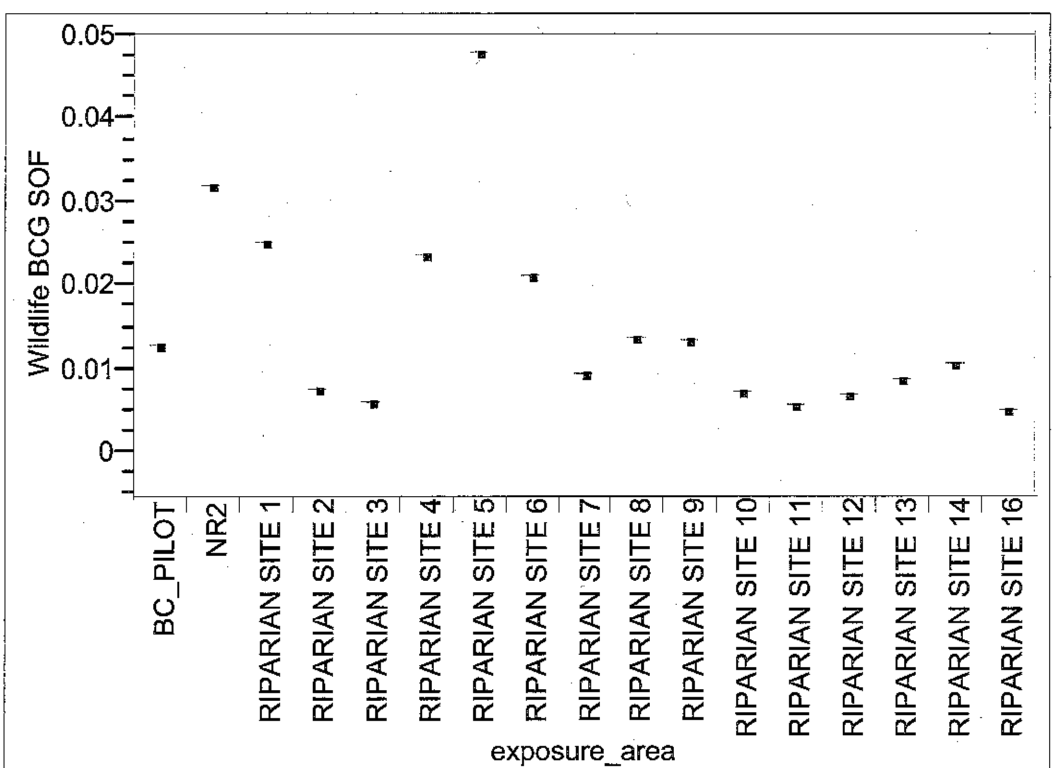


Figure 6-20a. Hazard Indices for Riparian Mourning Dove Grouped by Site Category.

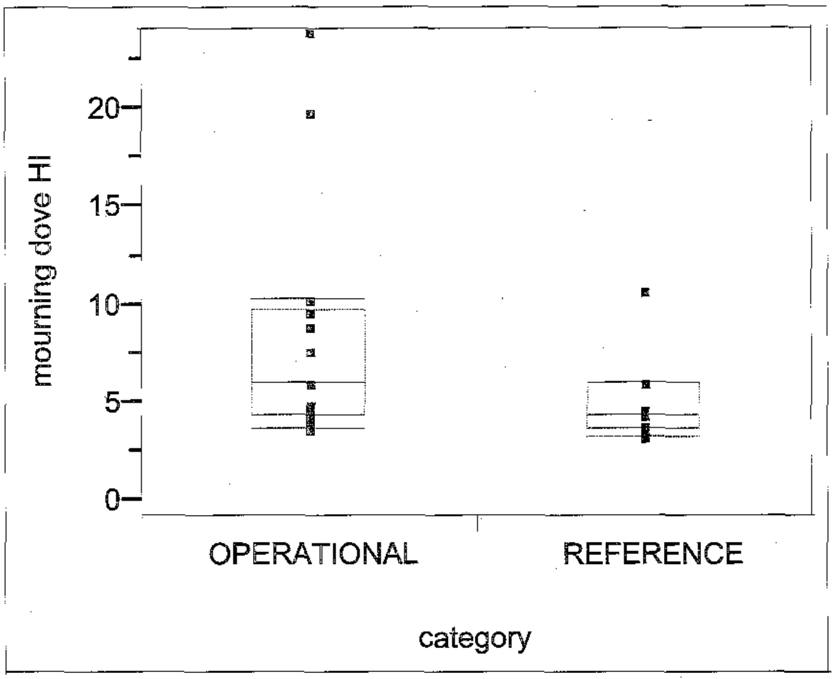


Figure 6-20b. Hazard Indices for Riparian Mourning Dove Grouped by Individual Sites.

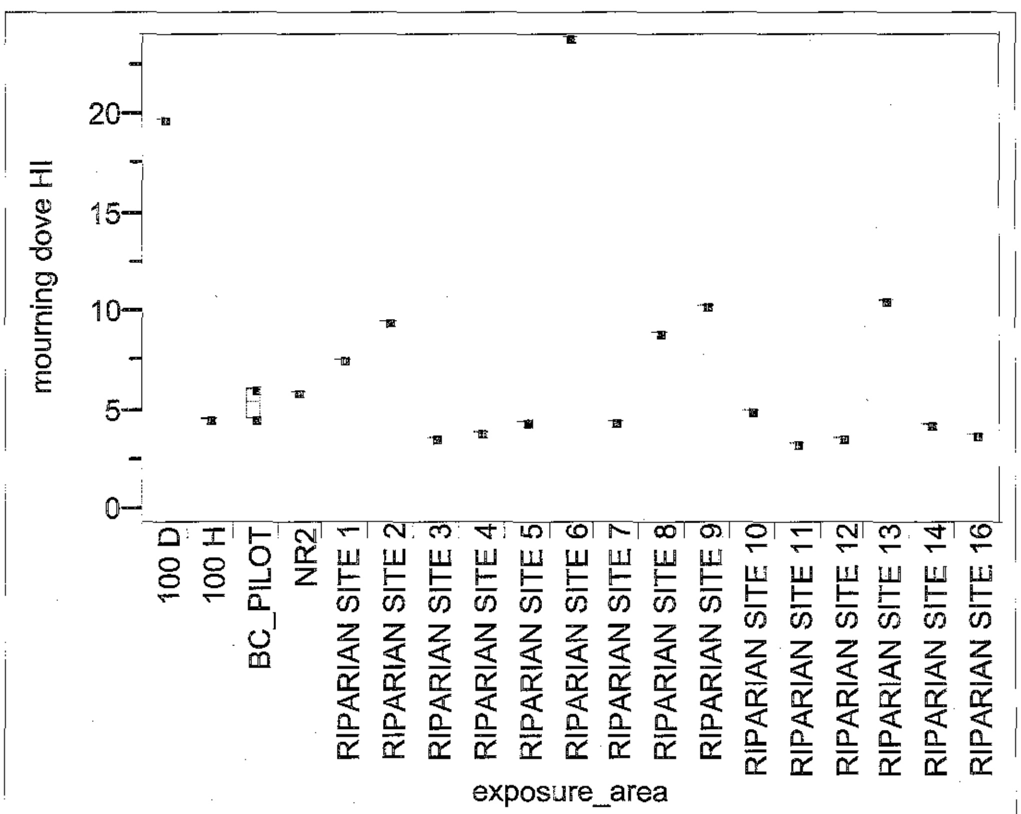


Figure 6-21a. Hazard Indices for Riparian Pocket Mouse Grouped by Site Category.

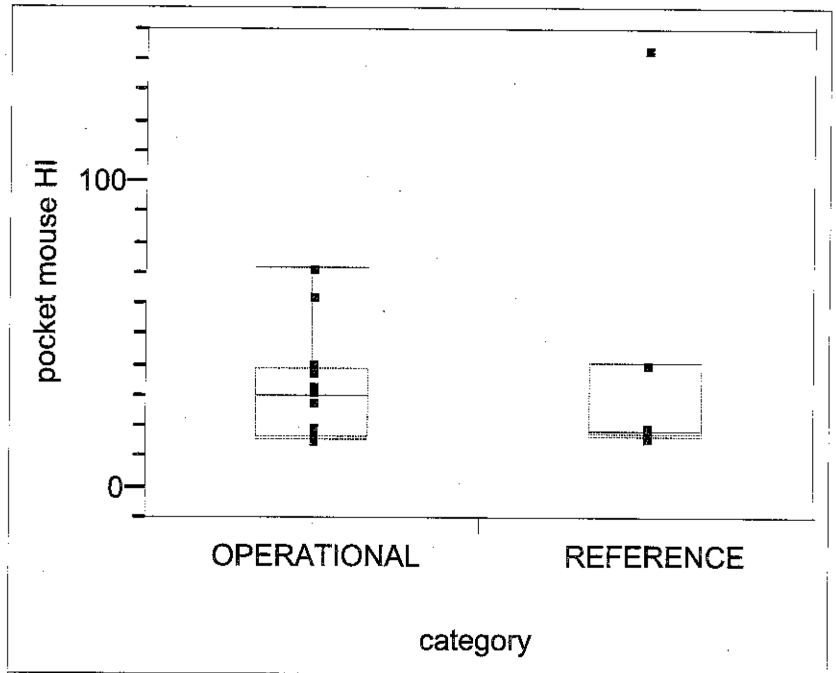


Figure 6-21b. Hazard Indices for Riparian Pocket Mouse Grouped by Individual Sites.

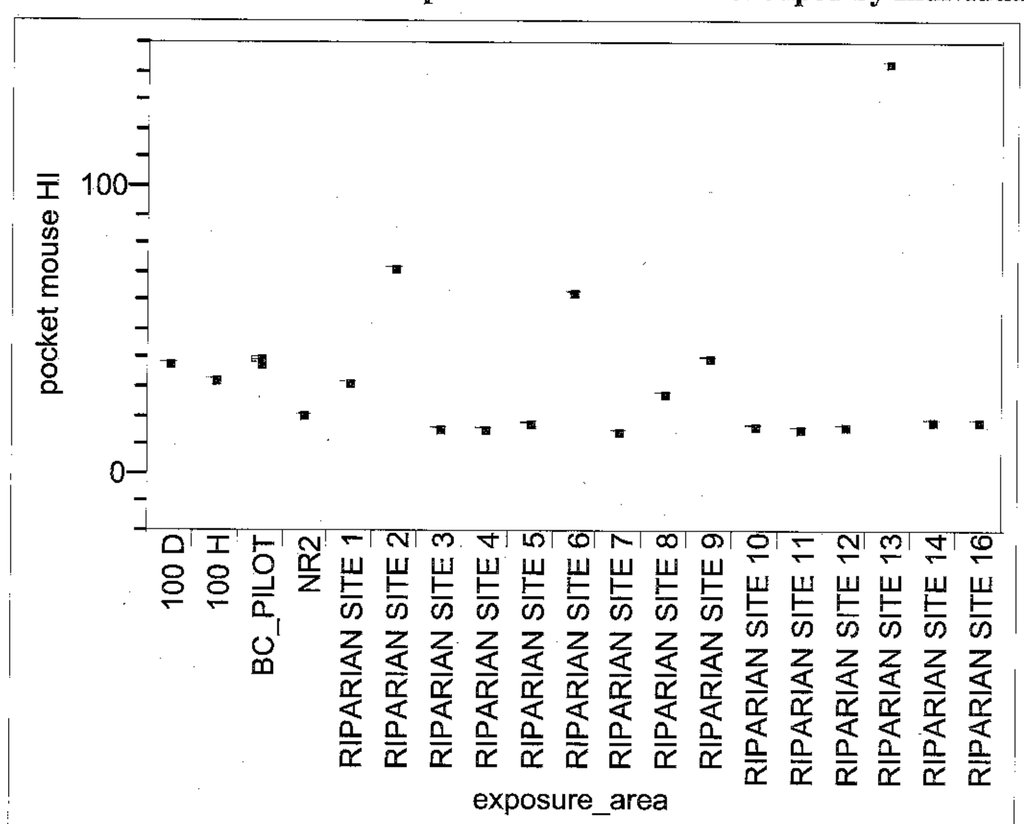


Figure 6-22a. Hazard Indices for Riparian Meadowlark Grouped by Site Category.

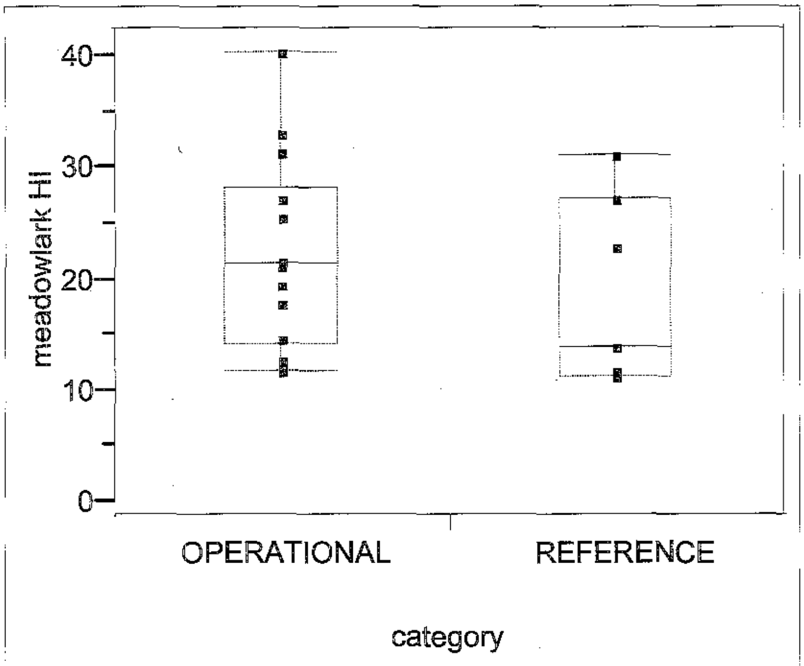


Figure 6-22b. Hazard Indices for Riparian Meadowlark Grouped by Individual Sites.

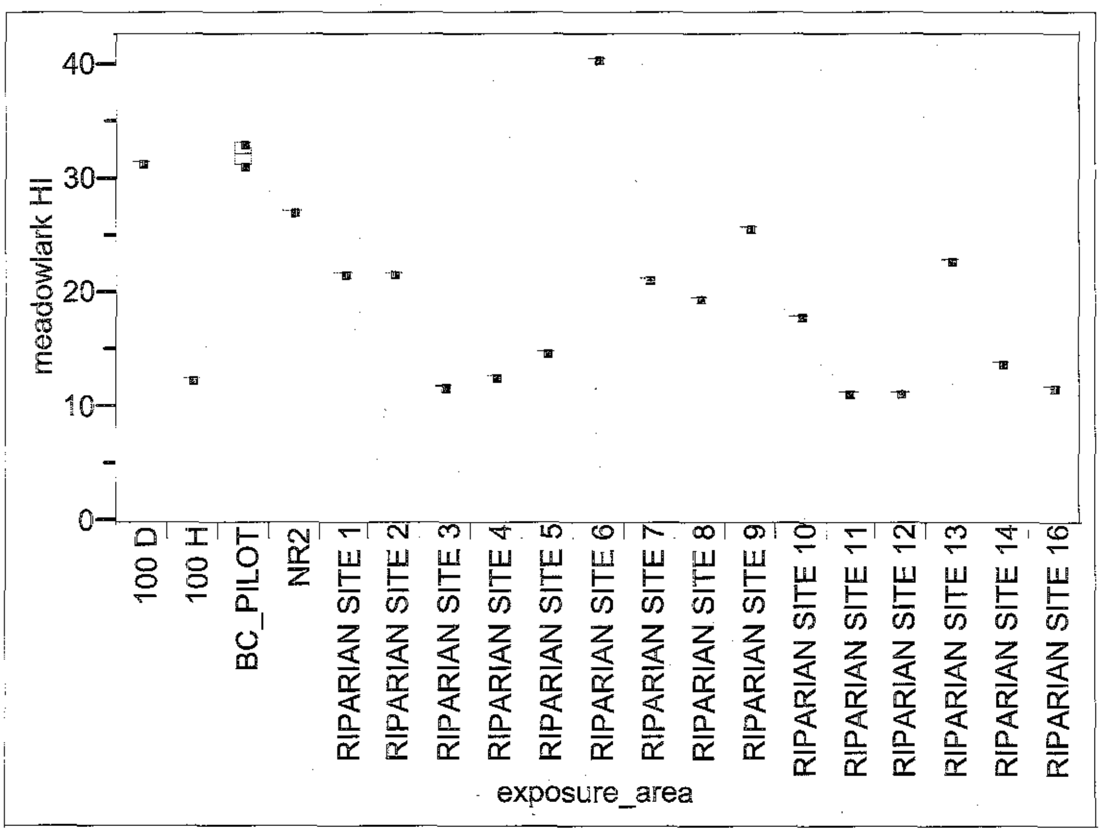


Figure 6-23a. Hazard Indices for Riparian Deer Mouse Grouped by Site Category.

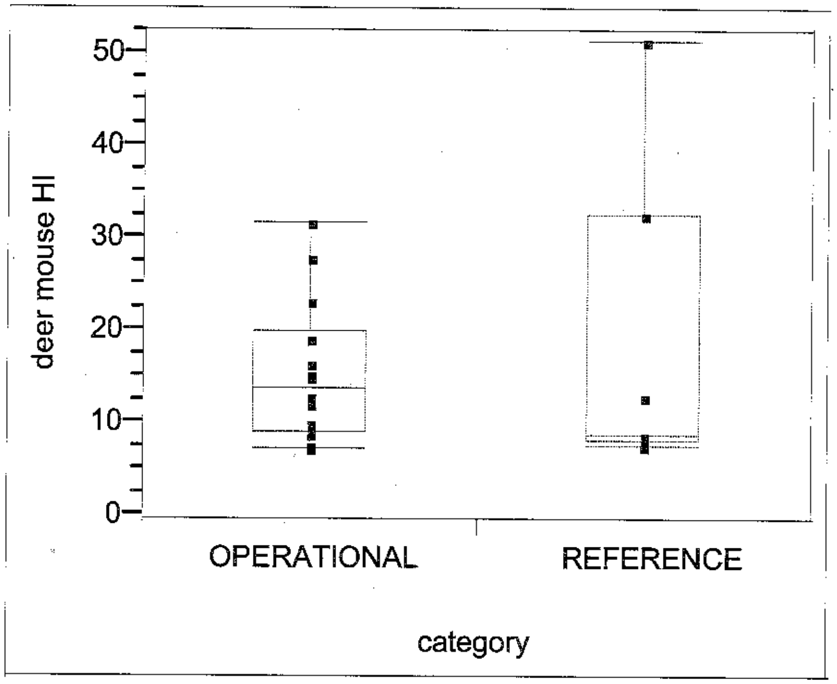


Figure 6-23b. Hazard Indices for Riparian Deer Mouse Grouped by Individual Sites.

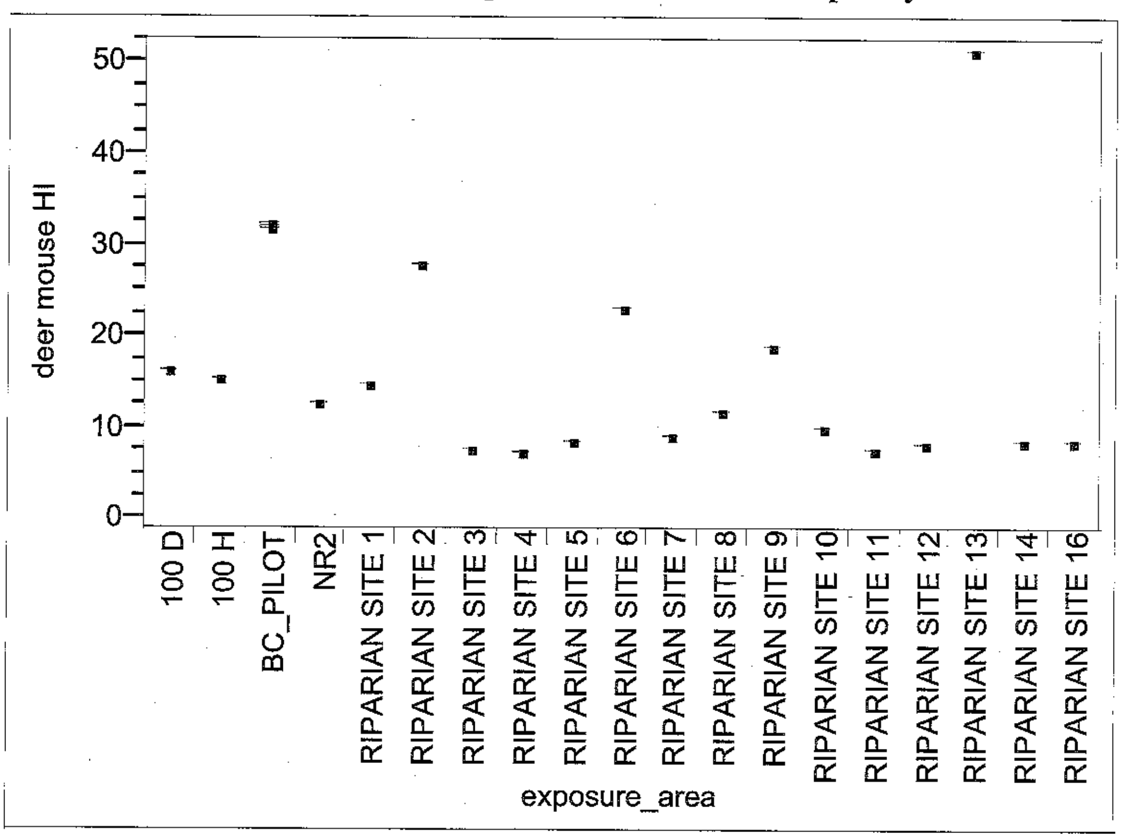


Figure 6-24a. Hazard Indices for Riparian Killdeer Grouped by Site Category.

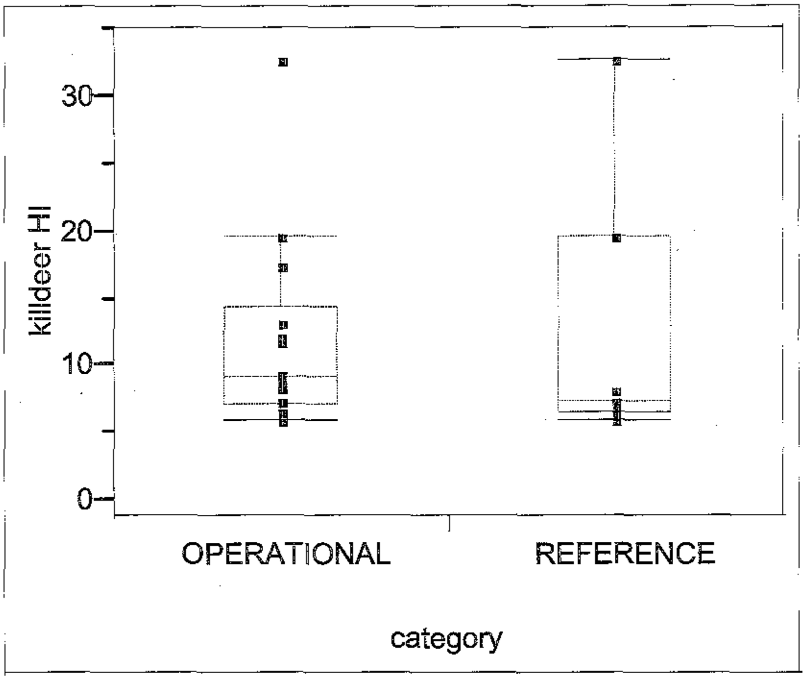


Figure 6-24b. Hazard Indices for Riparian Killdeer Grouped by Individual Sites.

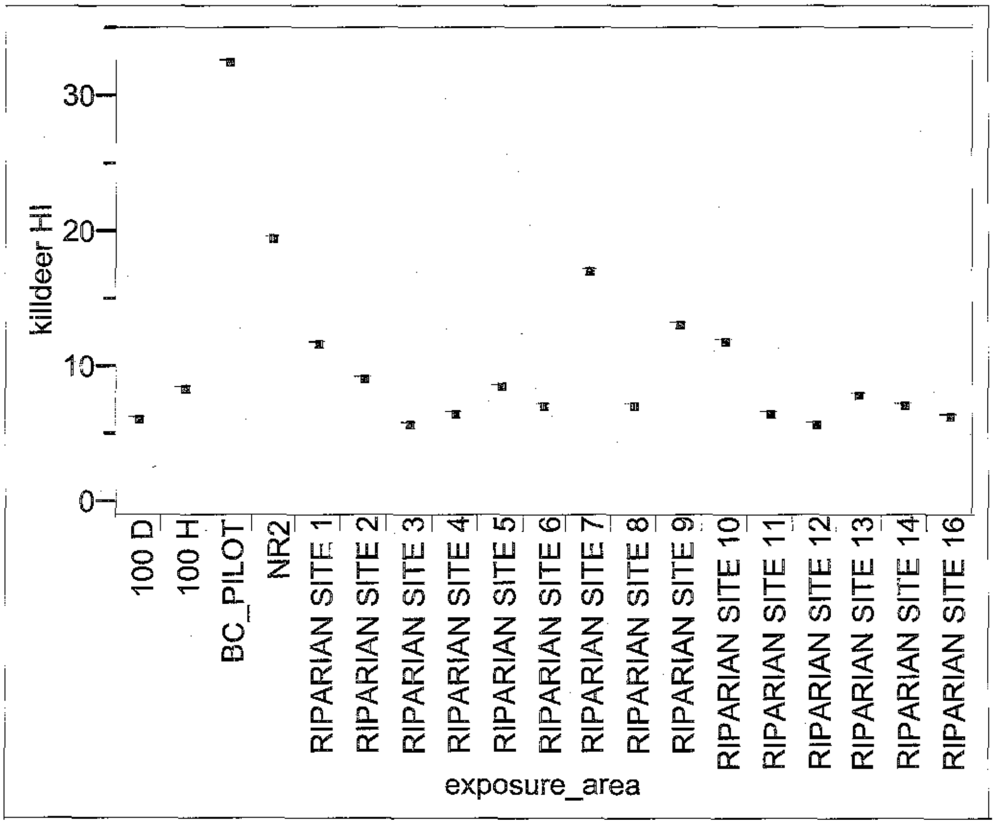


Figure 6-25a. Hazard Indices for Riparian Grasshopper Mouse Grouped by Site Category.

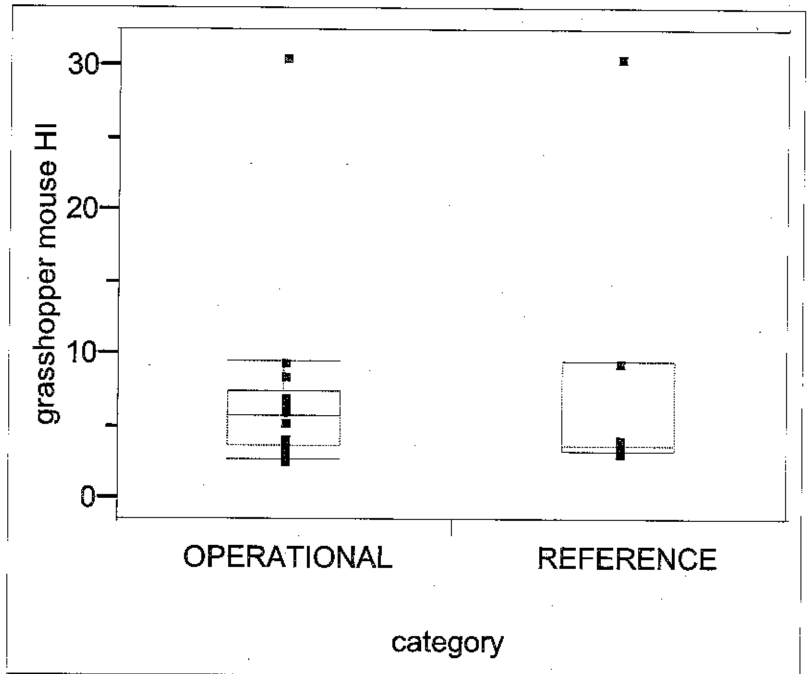


Figure 6-25b. Hazard Indices for Riparian Grasshopper Mouse Grouped by Individual Sites.

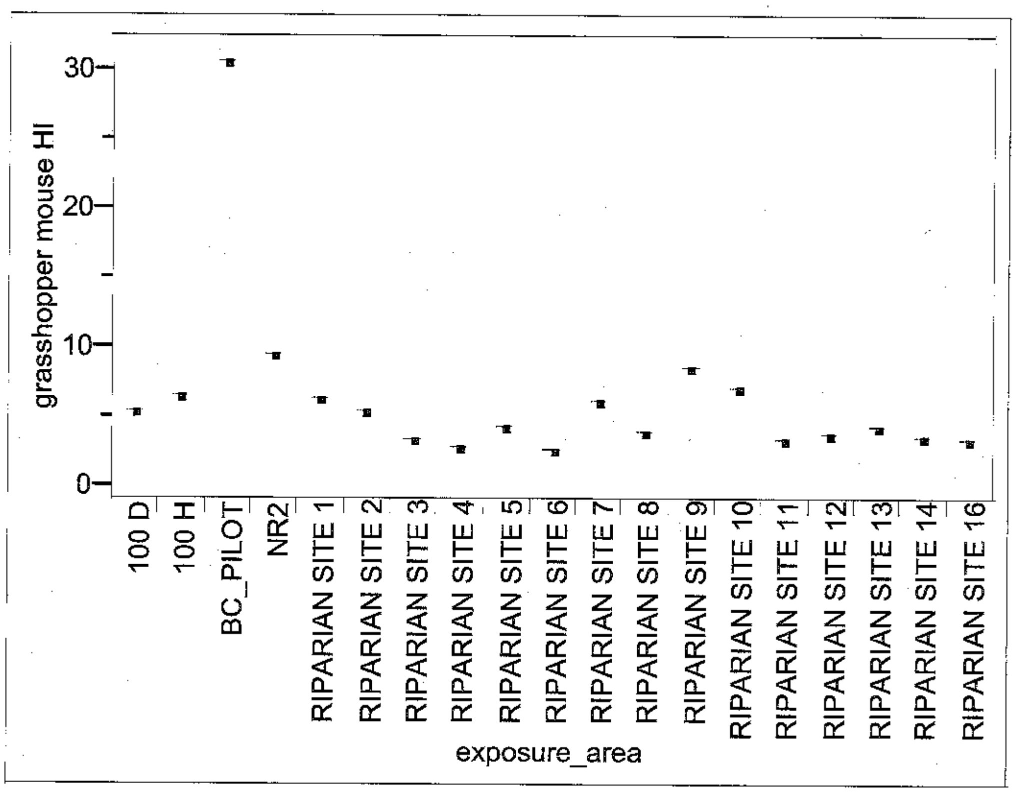


Figure 6-26a. Hazard Indices for Riparian Kingbird Grouped by Site Category.

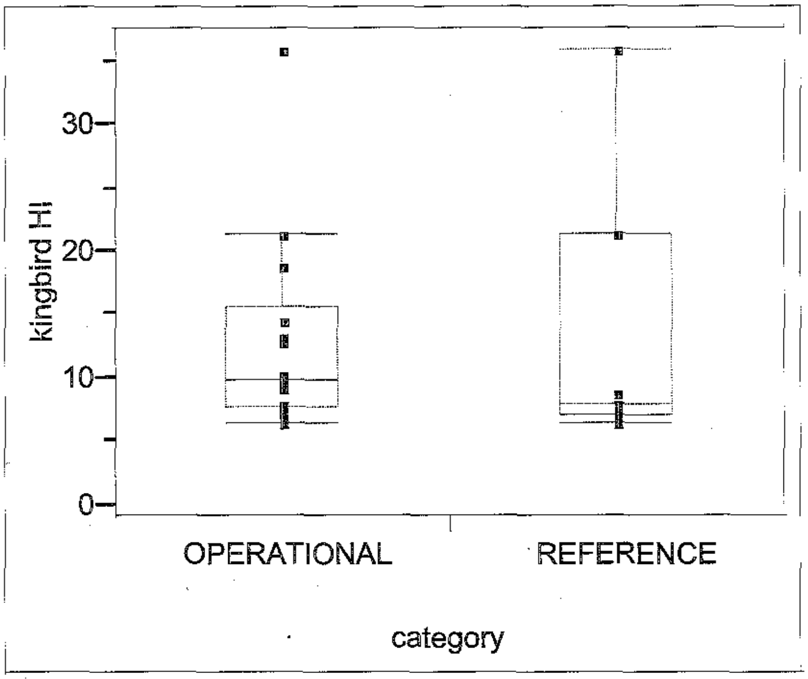


Figure 6-26b. Hazard Indices for Riparian Kingbird Grouped by Individual Sites.

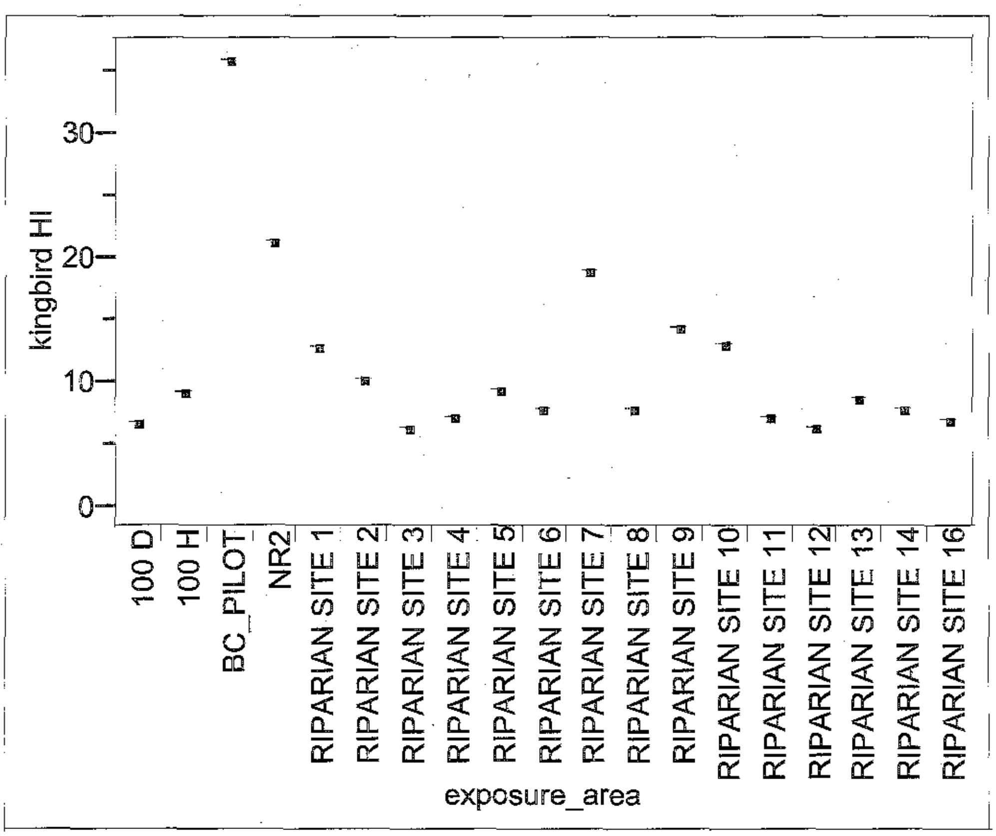


Figure 6-27a. Proportion Female:Male Small Mammals at Hanford Terrestrial Riparian Sites.

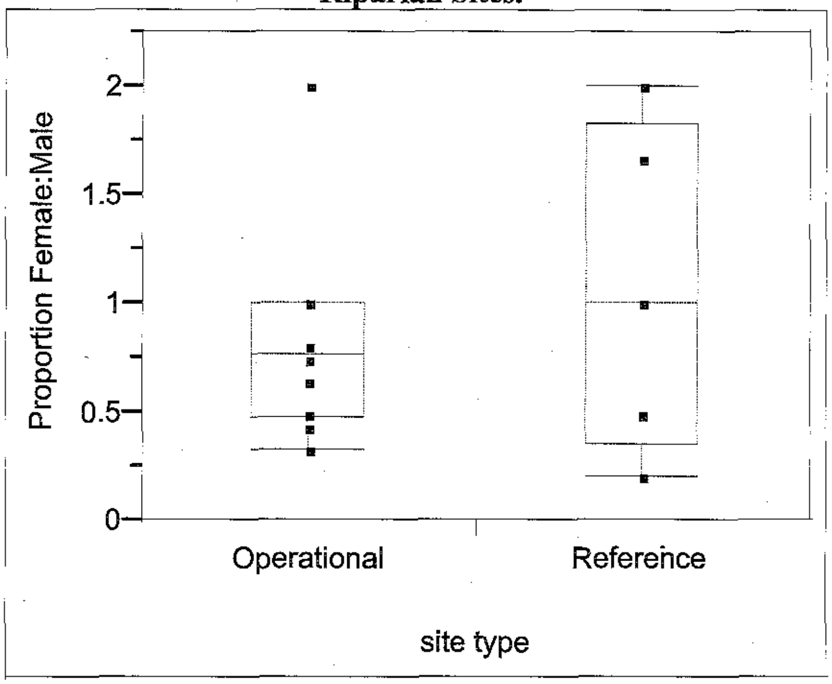


Figure 6-27b. Small Mammal Relative Abundance at Hanford Terrestrial Riparian Sites.

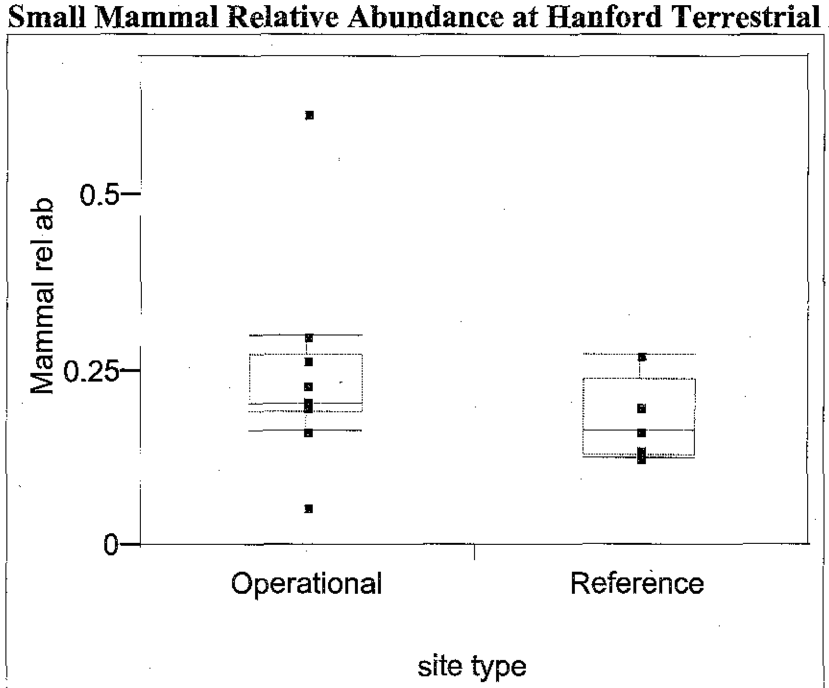


Figure 6-27c. Total Small Mammals at Hanford Terrestrial Riparian Sites.

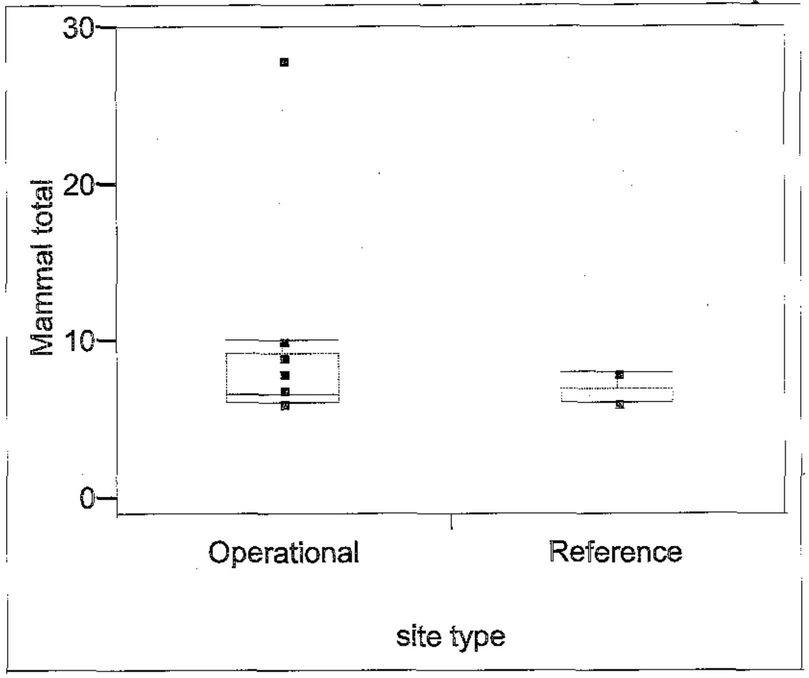


Figure 6-28a. Hazard Indices for Riparian Badger Grouped by Site Category.

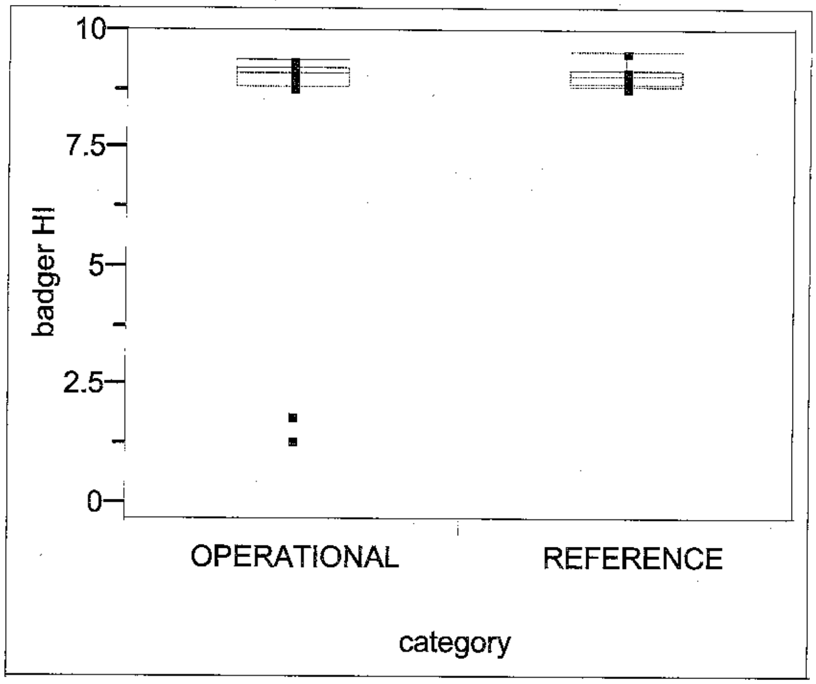


Figure 6-28b. Hazard Indices for Riparian Badger Grouped by Individual Sites.

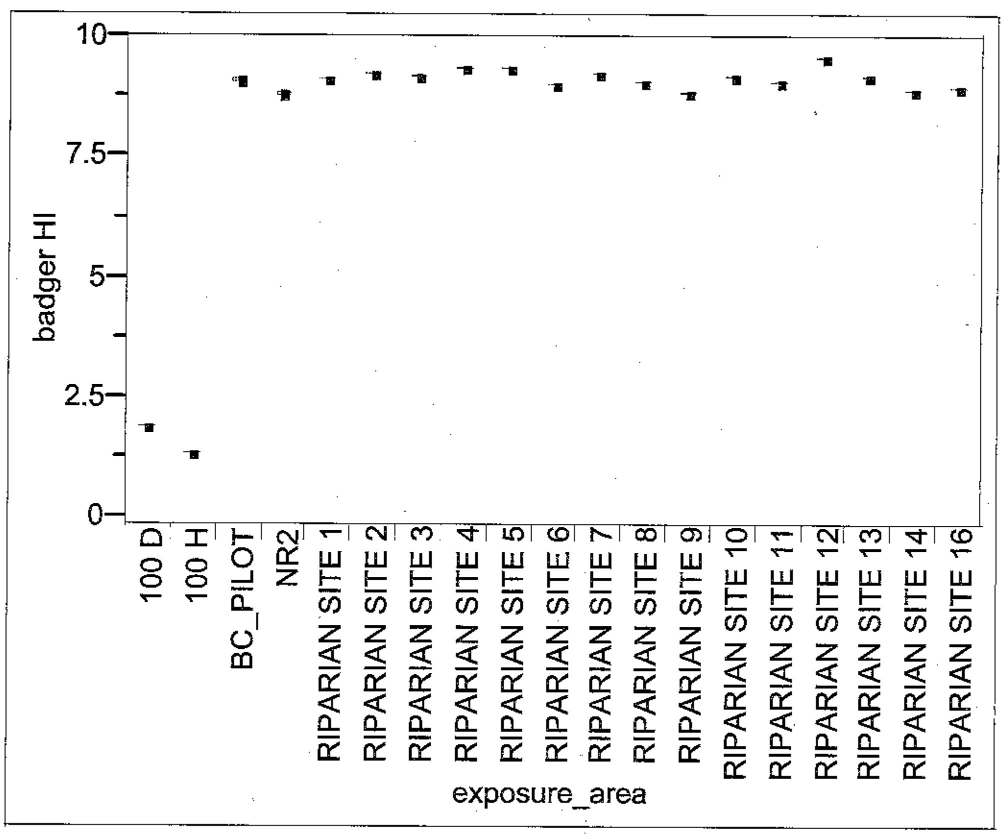


Figure 6-29a. Hazard Indices for Riparian Red-Tailed Hawk Grouped by Site Category.

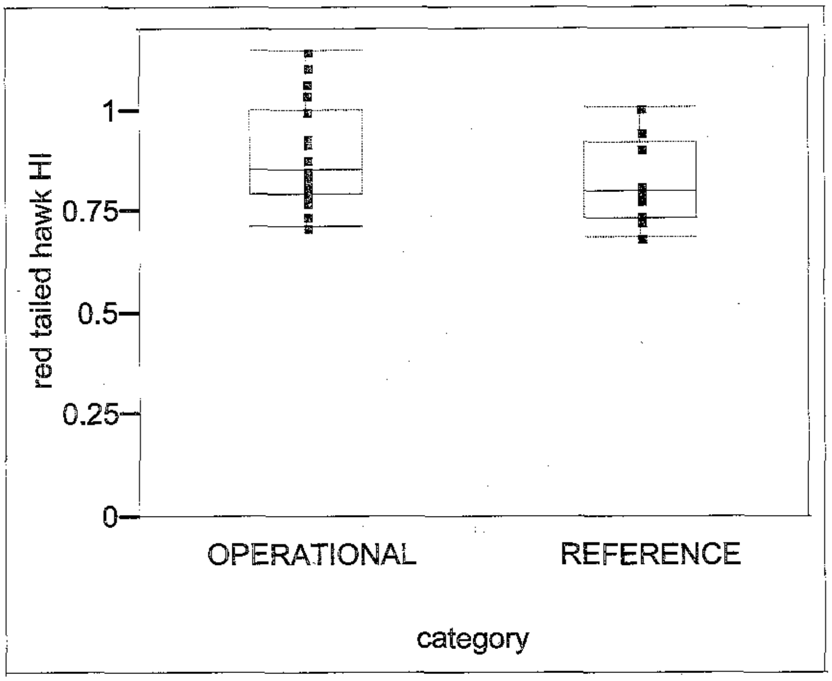


Figure 6-29b. Hazard Indices for Riparian Red-Tailed Hawk Grouped by Individual Sites.

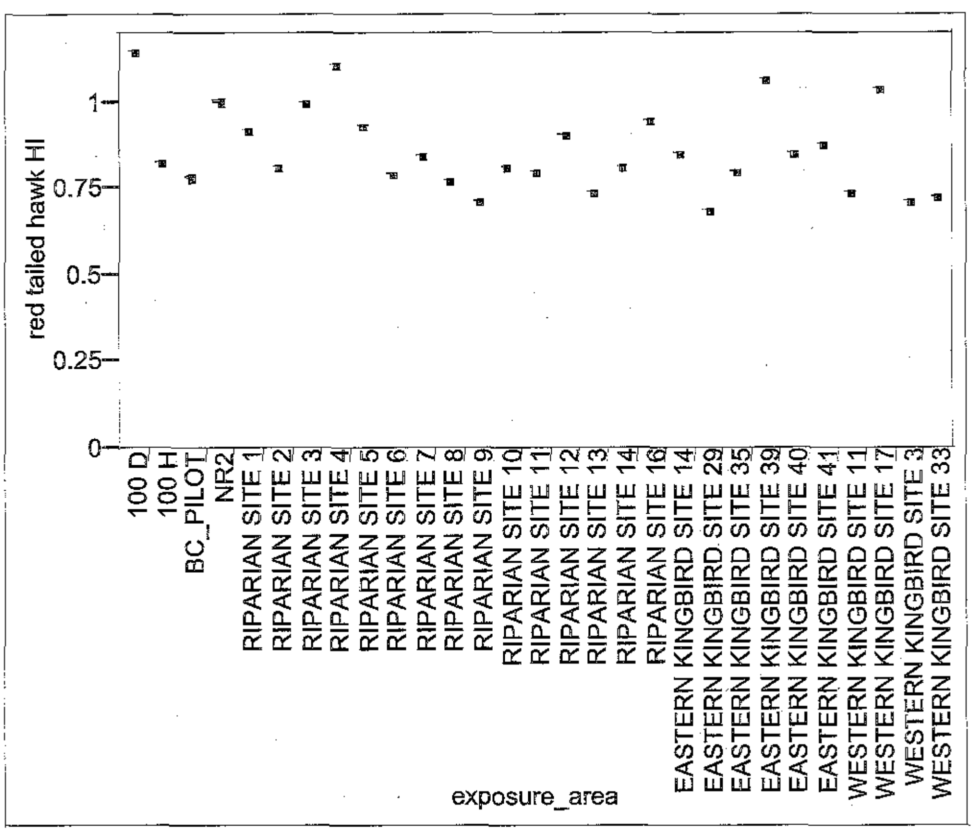
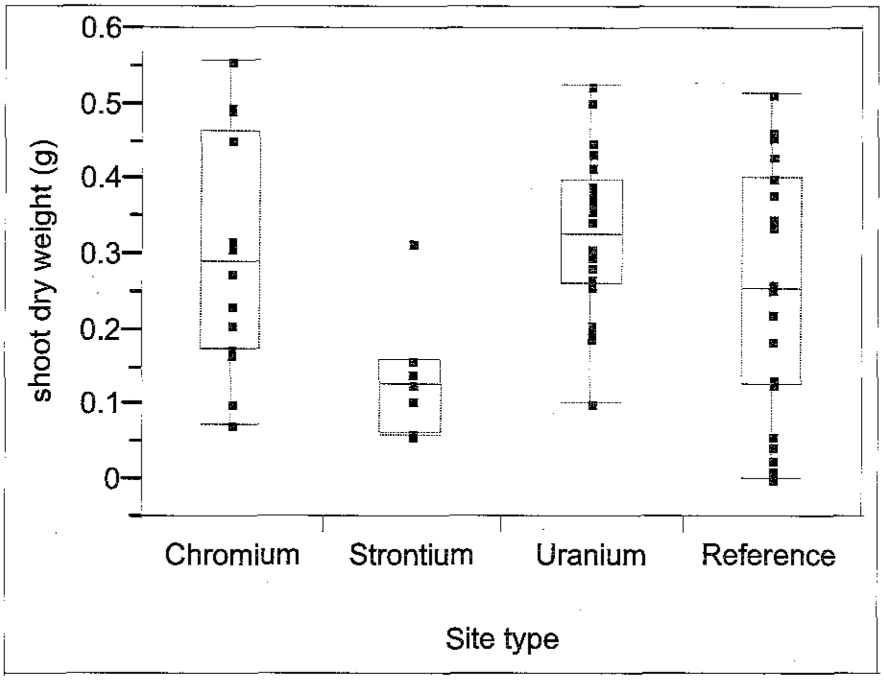


Figure 6-30. Pakchoi Growth (shoot dry weight) in Hanford Site Sediment.



The aquatic environment is comprised of chromium, strontium and uranium plumes and upriver reference sites.

Figure 6-31a. Hazard Indices for Near-Shore Aquatic Biota Grouped by Site Category.

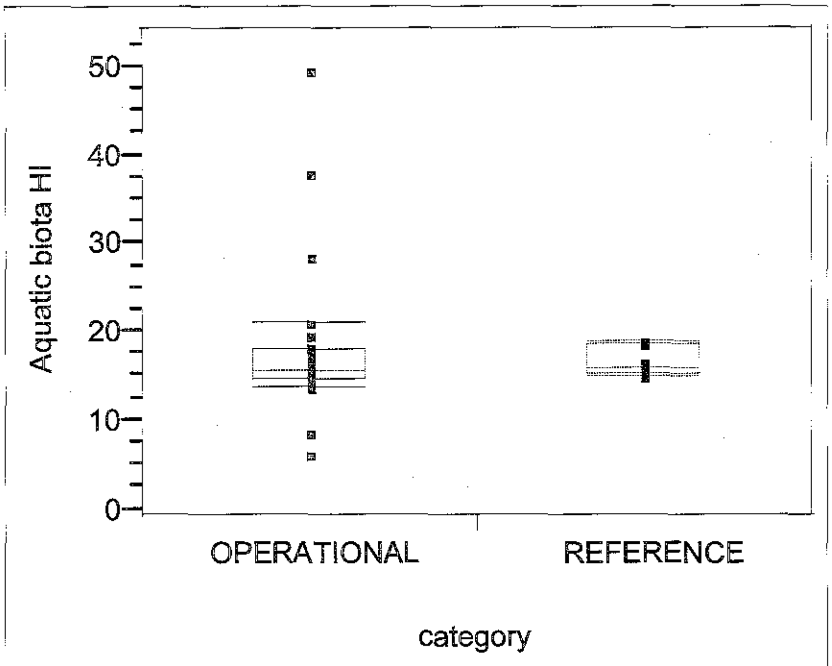


Figure 6-31b. Hazard Indices for Near-Shore Aquatic Biota Grouped by Individual Sites.

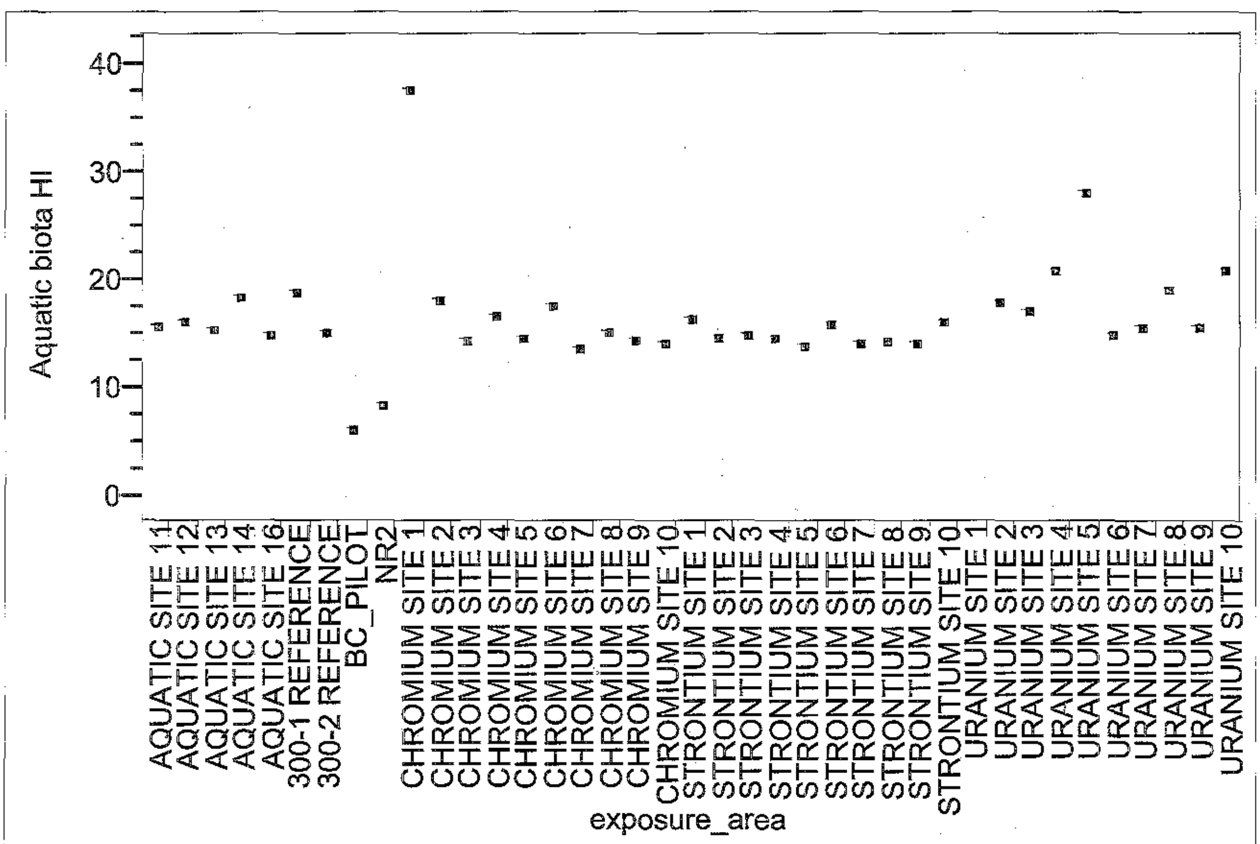


Figure 6-32a. Hazard Indices for Near-Shore Sediment Biota Grouped by Site Category.

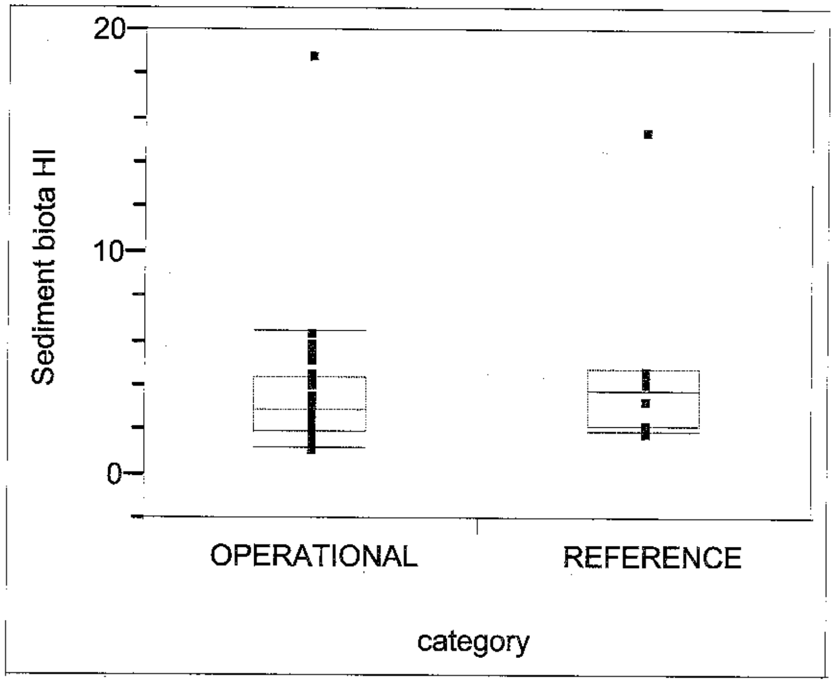


Figure 6-32b. Hazard Indices for Near-Shore Sediment Biota Grouped by Individual Sites.

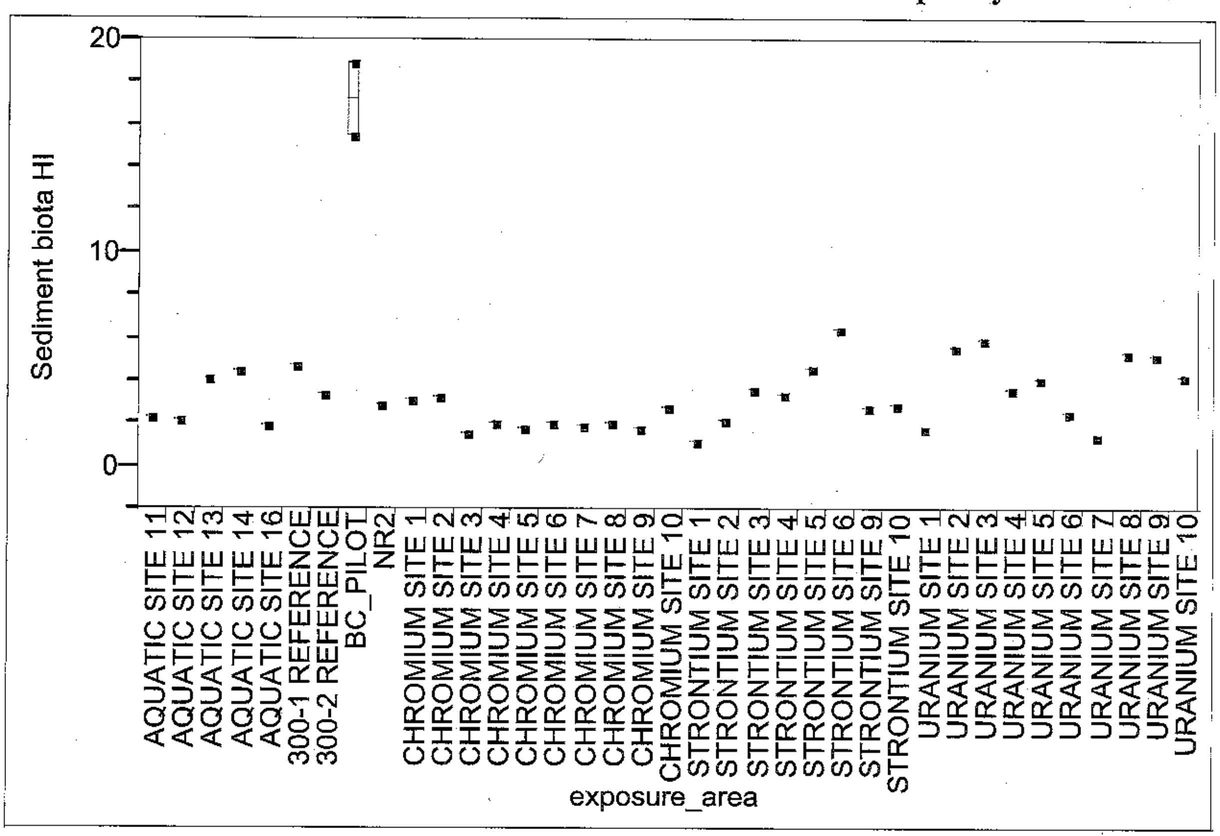


Figure 6-33a. ***Corbicula*** **Percent Survival in Hanford Site Sediment.**

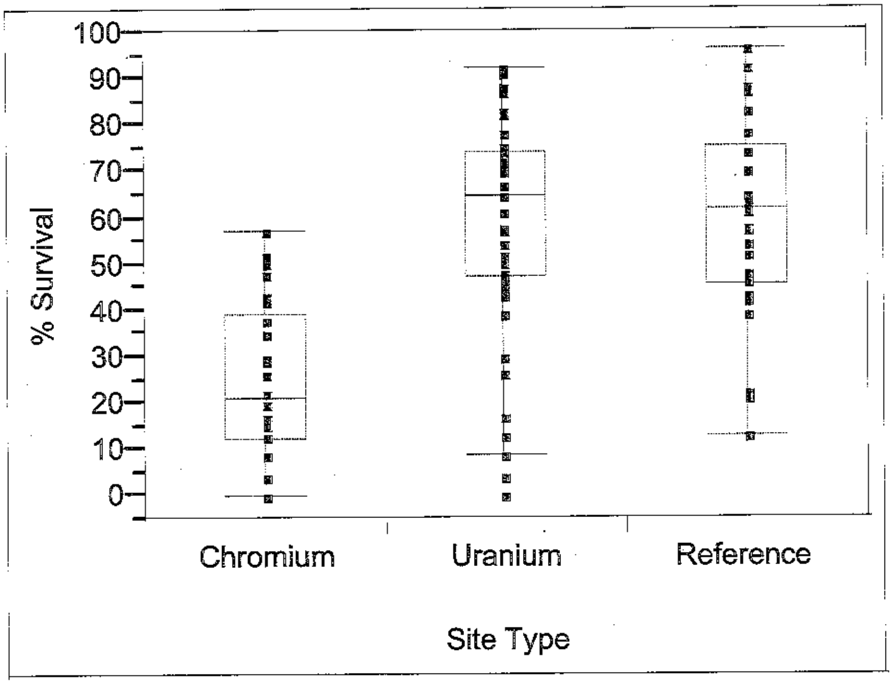
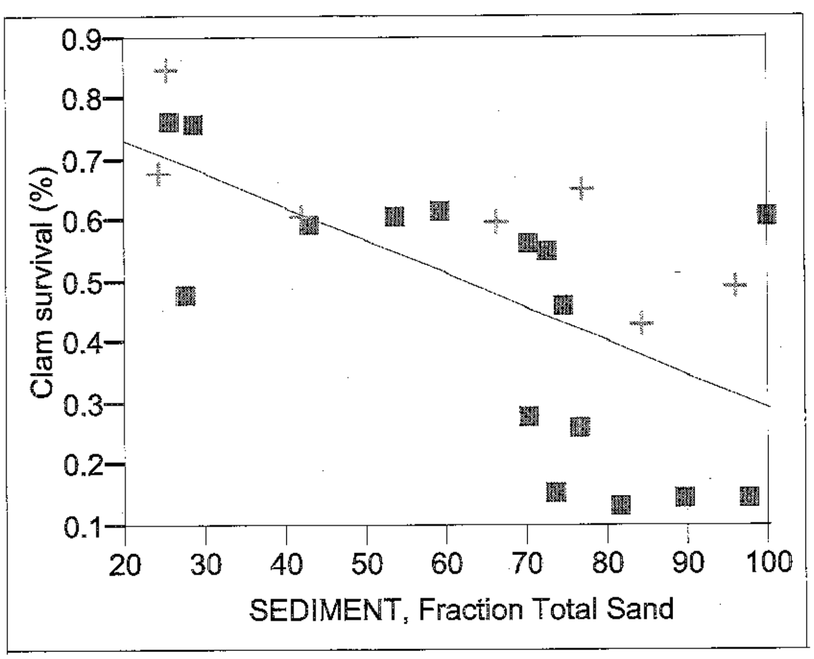
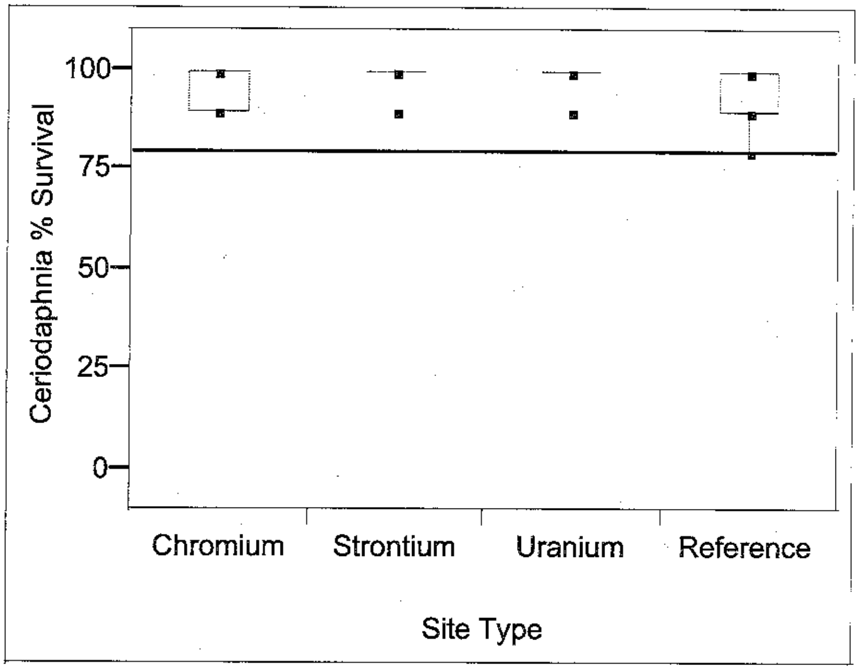


Figure 6-33b. ***Corbicula*** **Percent Survival and Fraction Total Sand.**



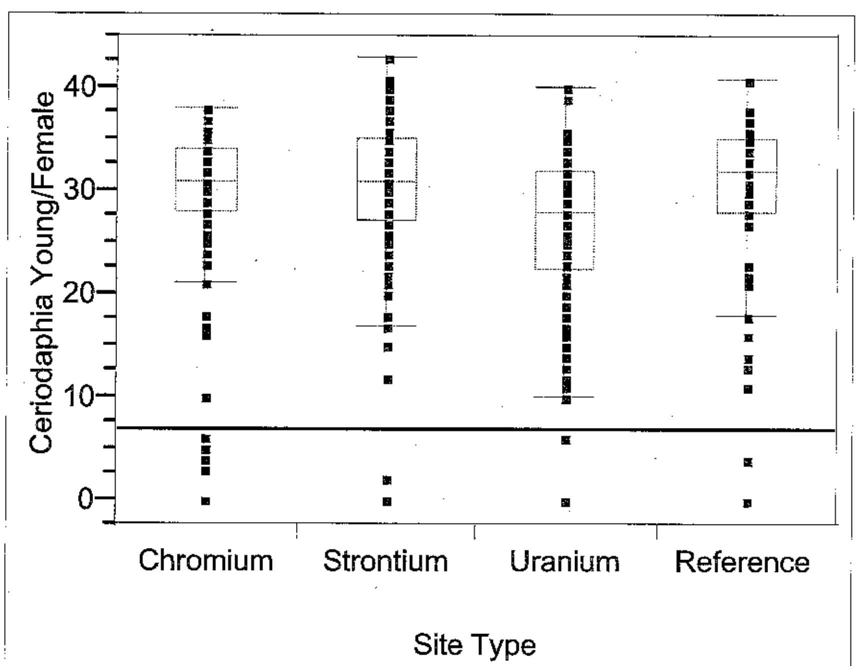
Symbols in red (▪) represent data from operational areas and green (+) represents aquatic reference sites

Figure 6-34a. *Ceriodaphnia* Survival in Hanford Site Pore Water.



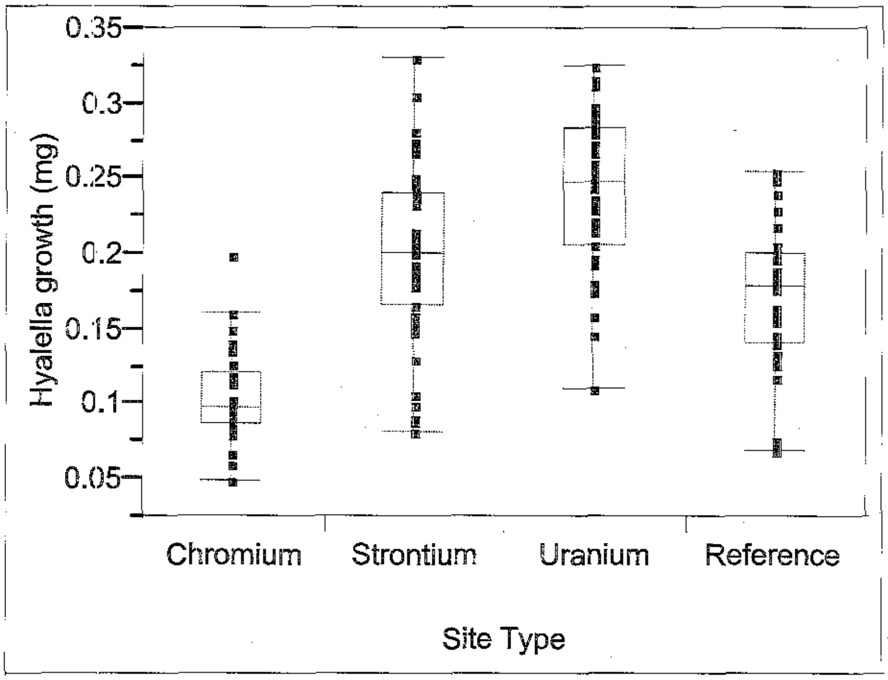
The aquatic environment is comprised of chromium, strontium and uranium plumes and upriver reference sites. The solid line represents survival in the presence of a reference toxicant (80% survival at 1.5 g/ml sodium chloride).

Figure 6-34b. *Ceriodaphnia* Reproduction in Hanford Site Pore Water.



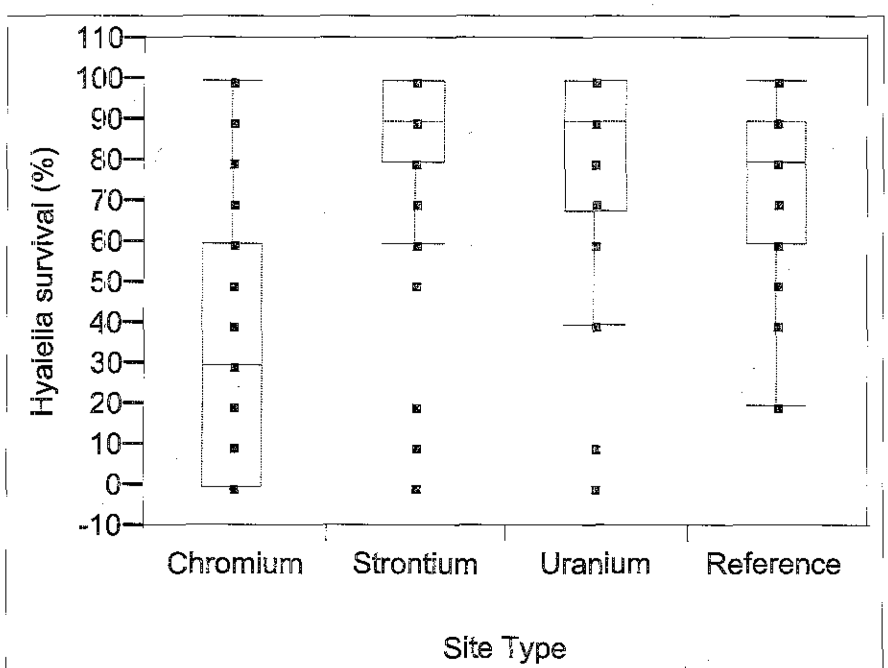
The aquatic environment is comprised of chromium, strontium and uranium plumes and upriver reference sites. The solid line represents reproduction in the presence of a reference toxicant (7 young/female at 1.5 g/ml sodium chloride).

Figure 6-35a. *Hyalella azteca* Growth in Hanford Site Sediment.



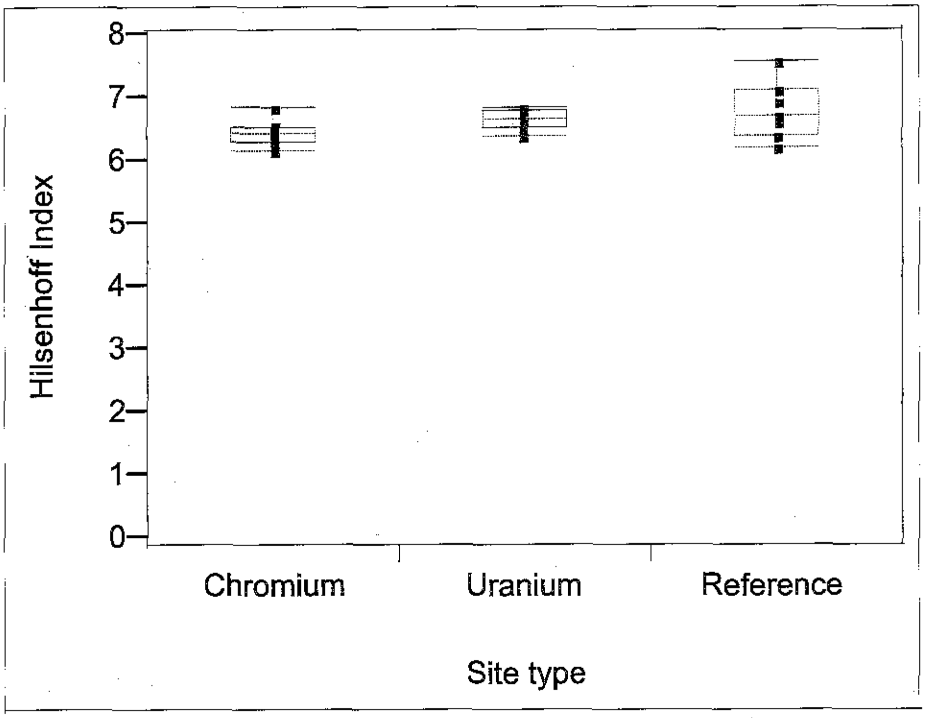
The aquatic environment is comprised of chromium, strontium and uranium plumes and upriver reference sites.

Figure 6-35b. *Hyalella azteca* Percent Survival in Hanford Site Sediment.



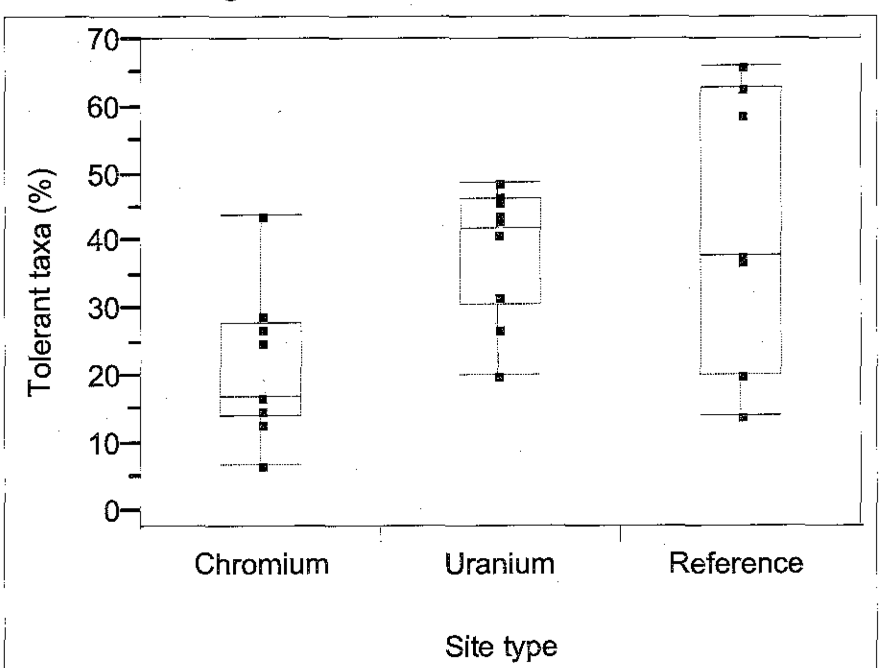
The aquatic environment is comprised of chromium, strontium and uranium plumes and upriver reference sites.

Figure 6-36. Hilsenhoff Family Biotic Index.



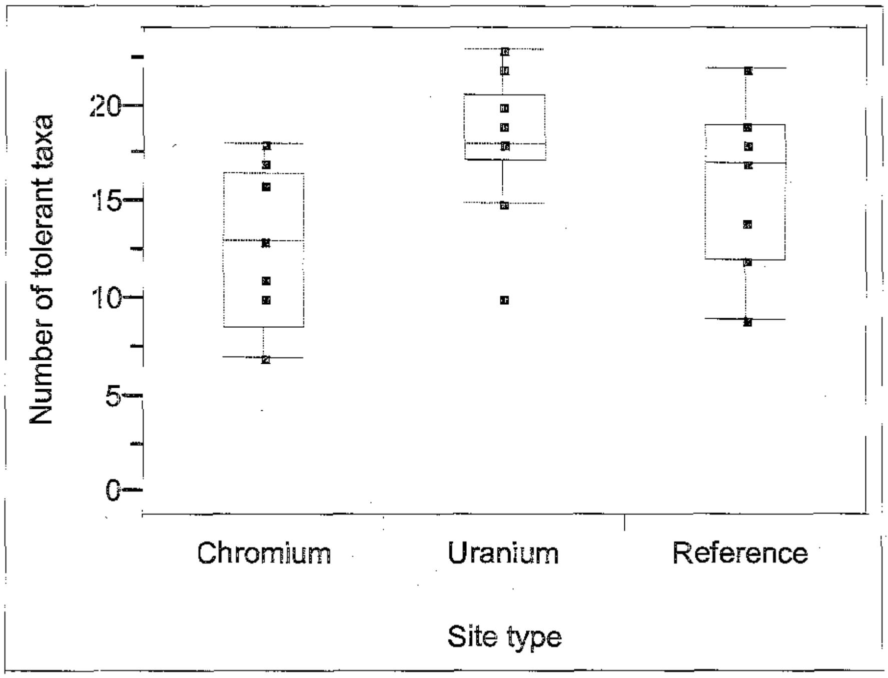
The aquatic environment is comprised of chromium and uranium plumes and upriver reference sites. Rock baskets were not deployed in the strontium plume.

Figure 6-37. Percent Tolerant Taxa.



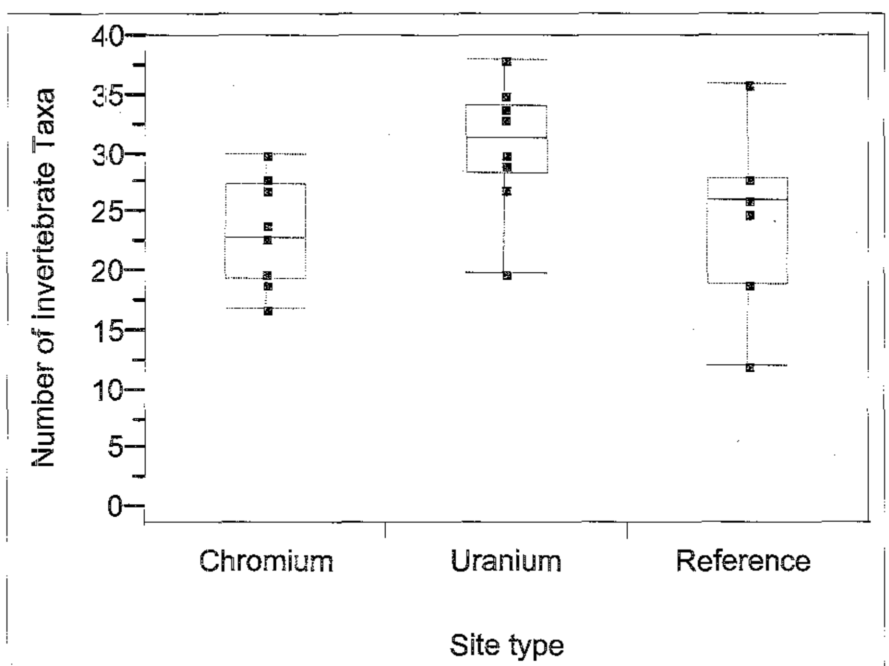
The aquatic environment is comprised of chromium and uranium plumes and upriver reference sites. Rock baskets were not deployed in the strontium plume.

Figure 6-38. Number of Tolerant Taxa.



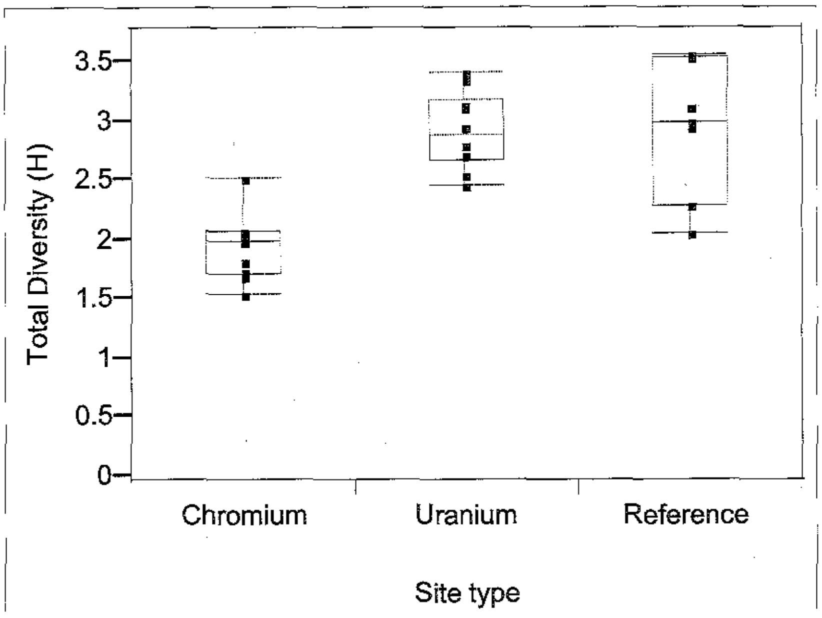
The aquatic environment is comprised of chromium and uranium plumes and upriver reference sites. Rock baskets were not deployed in the strontium plume.

Figure 6-39. Number of Benthic Macroinvertebrate Taxa.



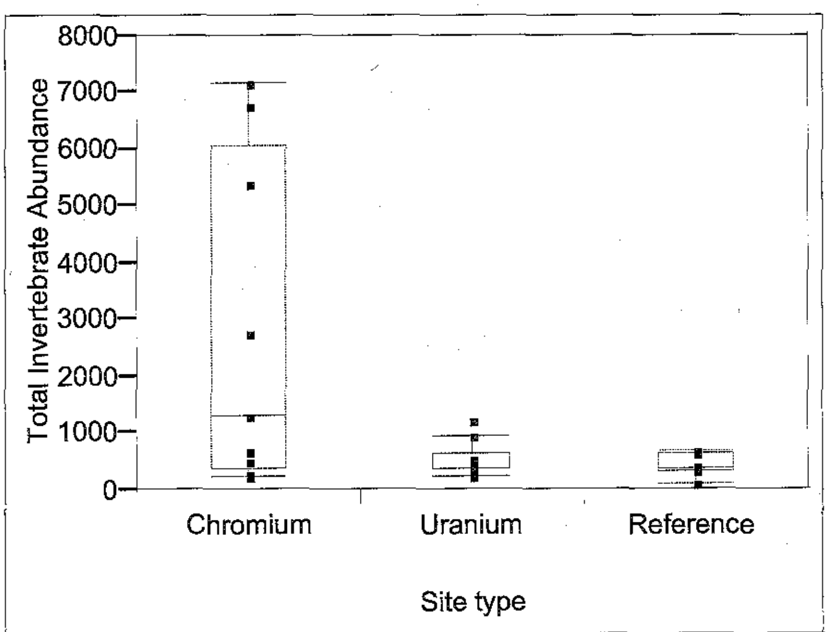
The aquatic environment is comprised of chromium and uranium plumes and upriver reference sites. Rock baskets were not deployed in the strontium plume.

Figure 6-40. Total Benthic Macroinvertebrate Diversity.



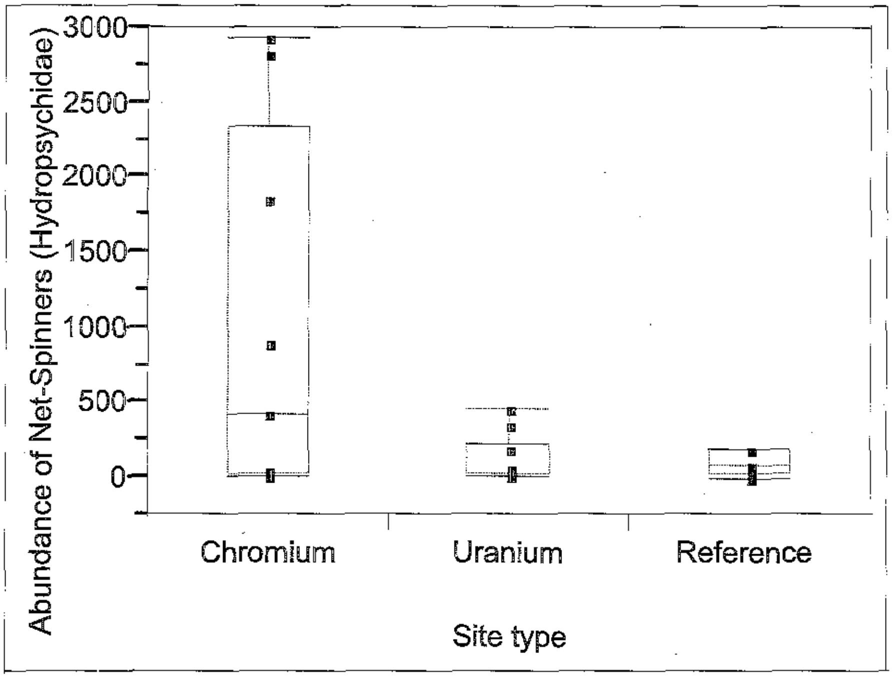
The aquatic environment is comprised of chromium and uranium plumes and upriver reference sites. Rock baskets were not deployed in the strontium plume.

Figure 6-41. Total Benthic Macroinvertebrate Abundance.



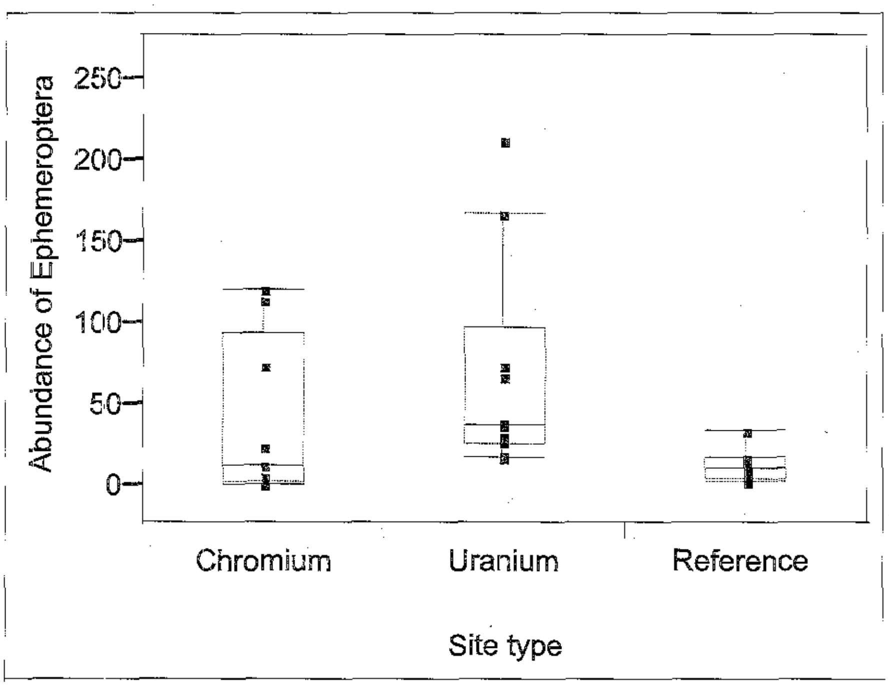
The aquatic environment is comprised of chromium and uranium plumes and upriver reference sites. Rock baskets were not deployed in the strontium plume.

Figure 6-42. Abundance of Net-Spinning Caddisflies (Trichoptera).



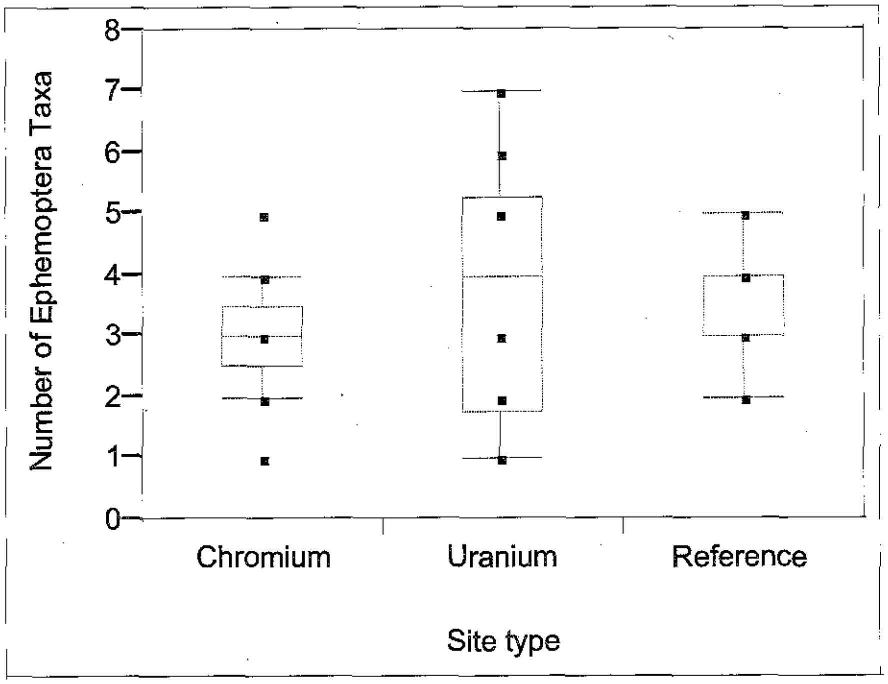
The aquatic environment is comprised of chromium and uranium plumes and upriver reference sites. Rock baskets were not deployed in the strontium plume.

Figure 6-43. Abundance of Mayfly (*Ephemeroptera*).



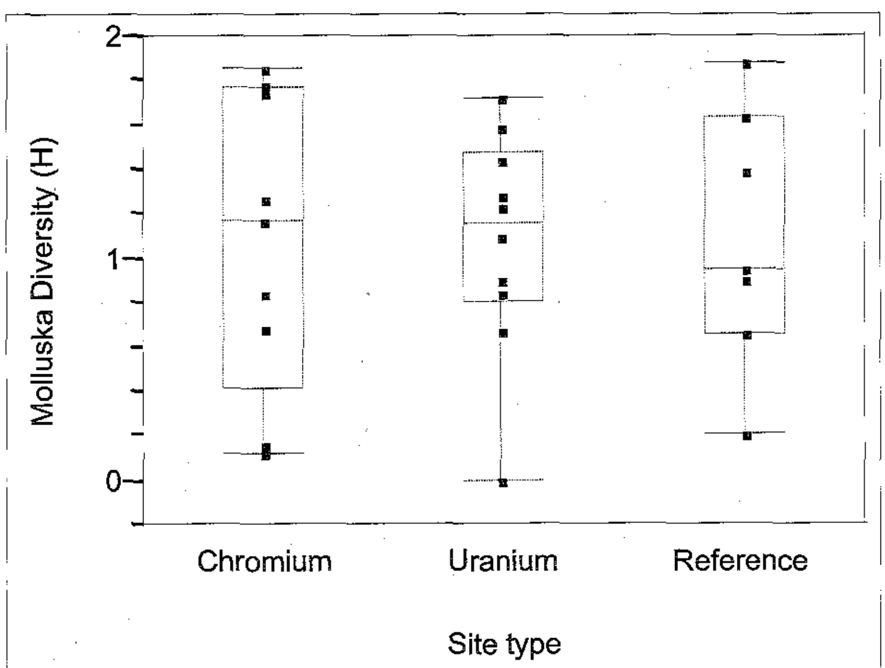
The aquatic environment is comprised of chromium and uranium plumes and upriver reference sites. Rock baskets were not deployed in the strontium plume.

Figure 6-44. Number of Mayfly (*Ephemeroptera*) Taxa.



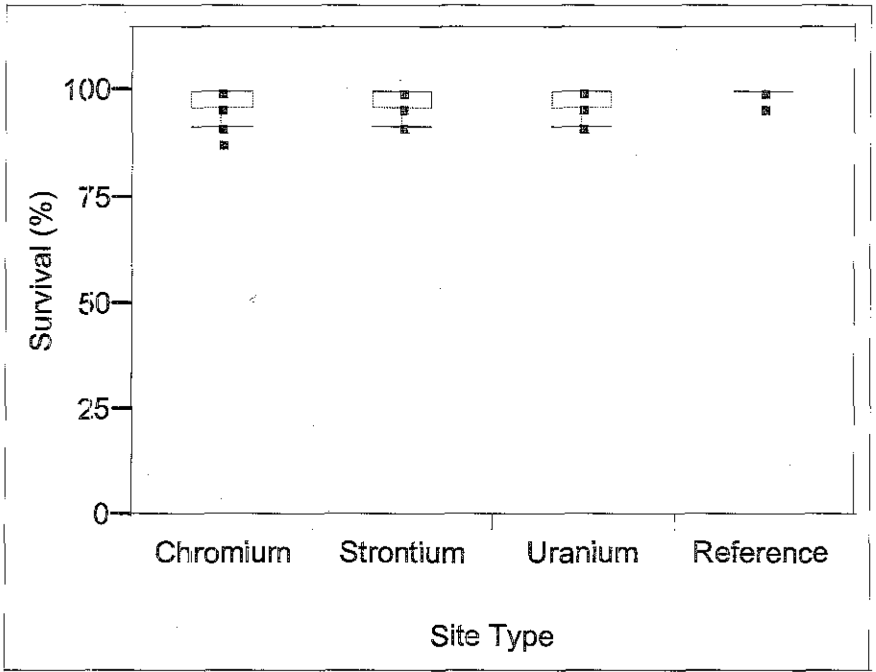
The aquatic environment is comprised of chromium and uranium plumes and upriver reference sites. Rock baskets were not deployed in the strontium plume.

Figure 6-45. Molluska Diversity.



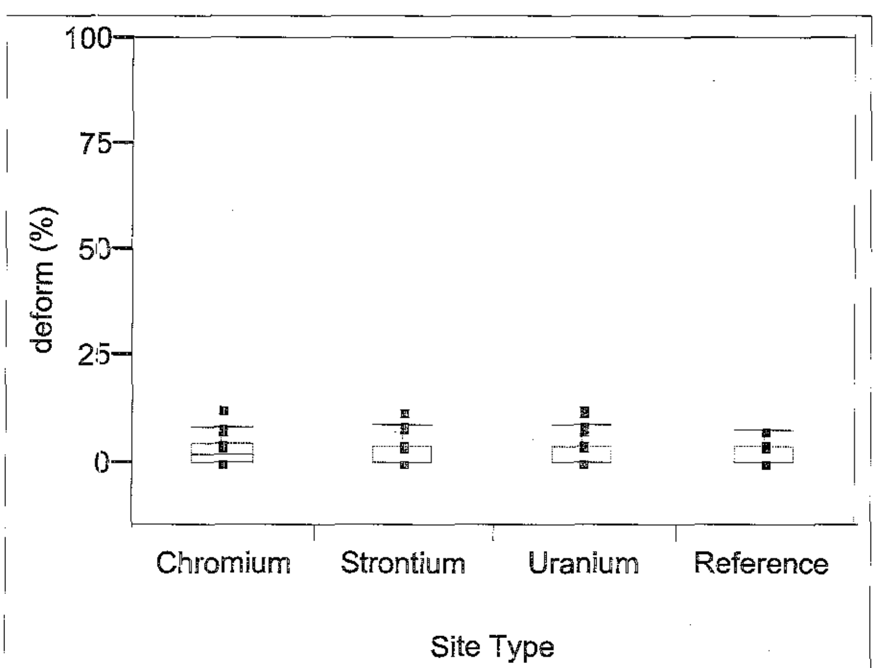
The aquatic environment is comprised of chromium and uranium plumes and upriver reference sites. Rock baskets were not deployed in the strontium plume.

Figure 6-46a. *Xenopus* Percent Survival in Hanford Site Pore Water.



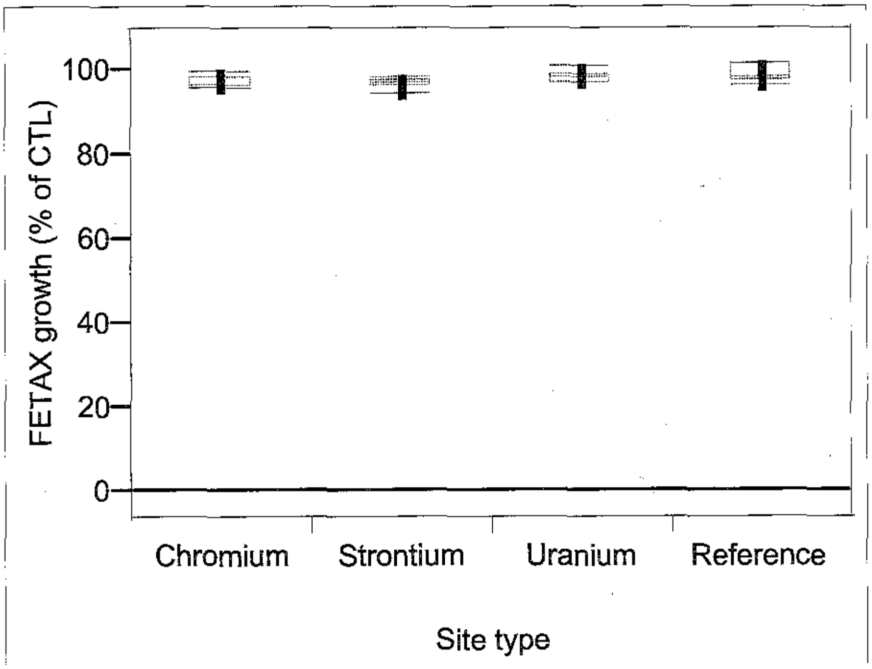
The aquatic environment is comprised of chromium, strontium and uranium plumes and upriver reference sites. The solid line represents survival in the presence of a reference toxicant (0% survival at 2500 mg/l 6-AN, a teratogenic chemical).

Figure 6-46b. *Xenopus* Percent Deformities in Hanford Site Pore Water.



The aquatic environment is comprised of chromium, strontium and uranium plumes and upriver reference sites. The solid lines represents deformities in the presence of a reference toxicant (46% to 56% at 5.5 mg/l 6-AN, a teratogenic chemical).

Figure 6-46c. *Xenopus* Percent Deformities in Hanford Site Pore Water.



The aquatic environment is comprised of chromium, strontium and uranium plumes and upriver reference sites. The solid lines represents deformities in the presence of a reference toxicant (0% at 2500 mg/l 6-AN, a teratogenic chemical).

Figure 6-47a. Radionuclide Sum of Fractions for Aquatic Wildlife Associated with Water Grouped by Site Category.

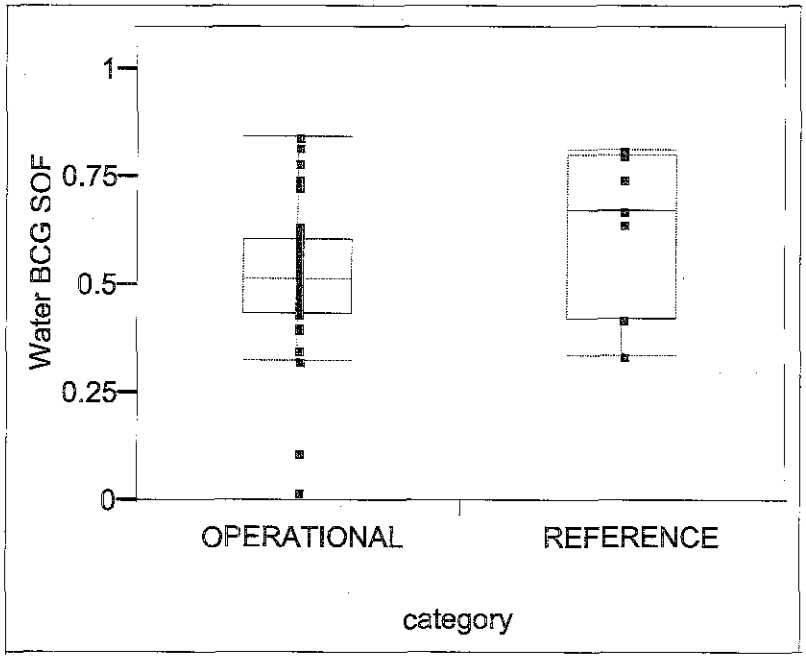


Figure 6-47b. Radionuclide Sum of Fractions for Aquatic Wildlife Associated with Water Grouped by Individual Sites.

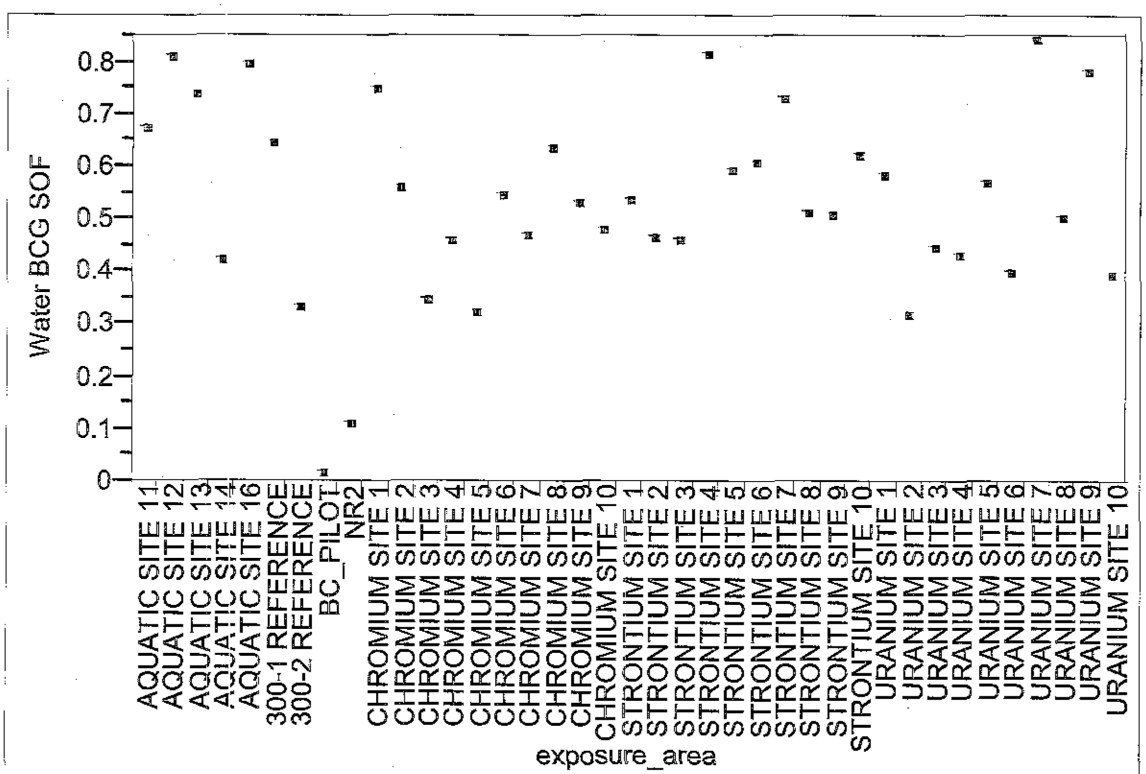


Figure 6-48a. Radionuclide Sum of Fractions for Aquatic Wildlife Associated with Sediment Grouped by Site Category.

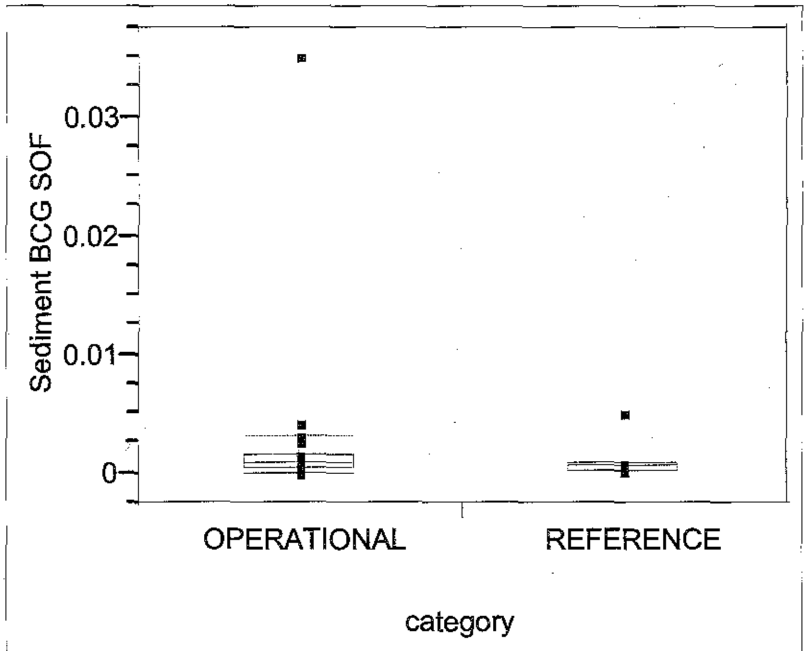


Figure 6-48b. Radionuclide Sum of Fractions for Aquatic Wildlife Associated with Sediment Grouped by Individual Sites.

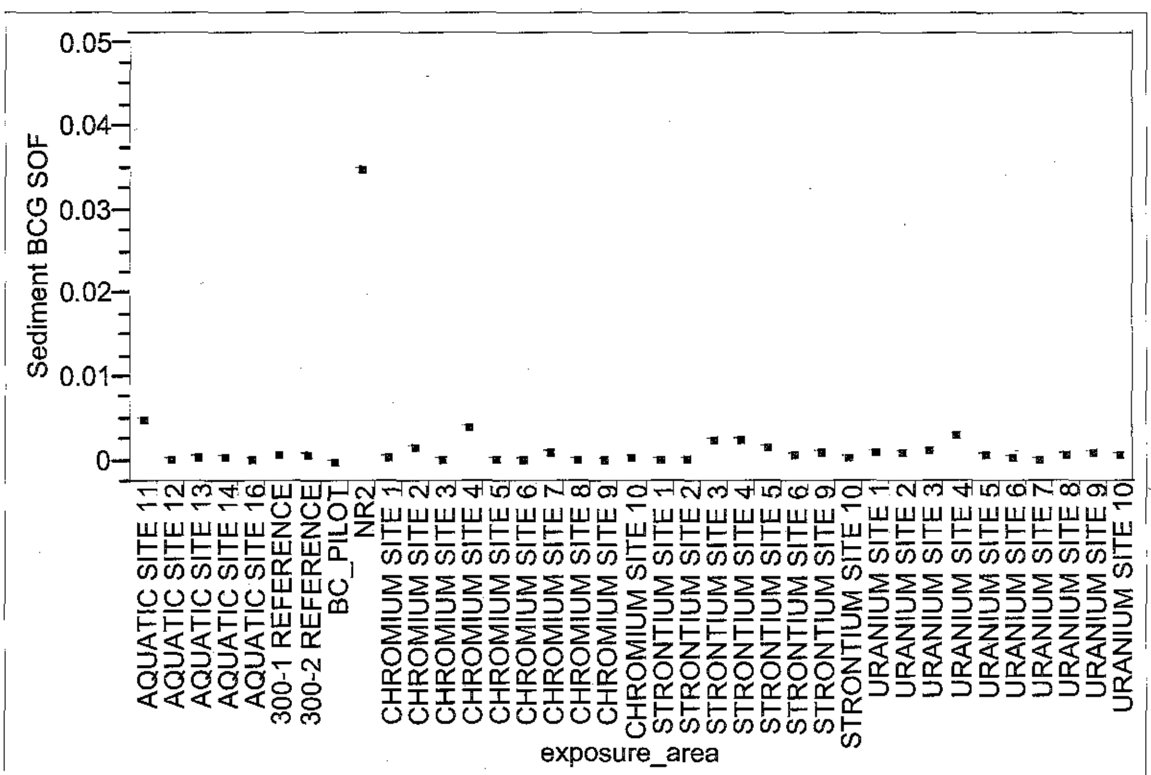


Figure 6-49a. Hazard Indices for Near-Shore Kingbirds Grouped by Category.

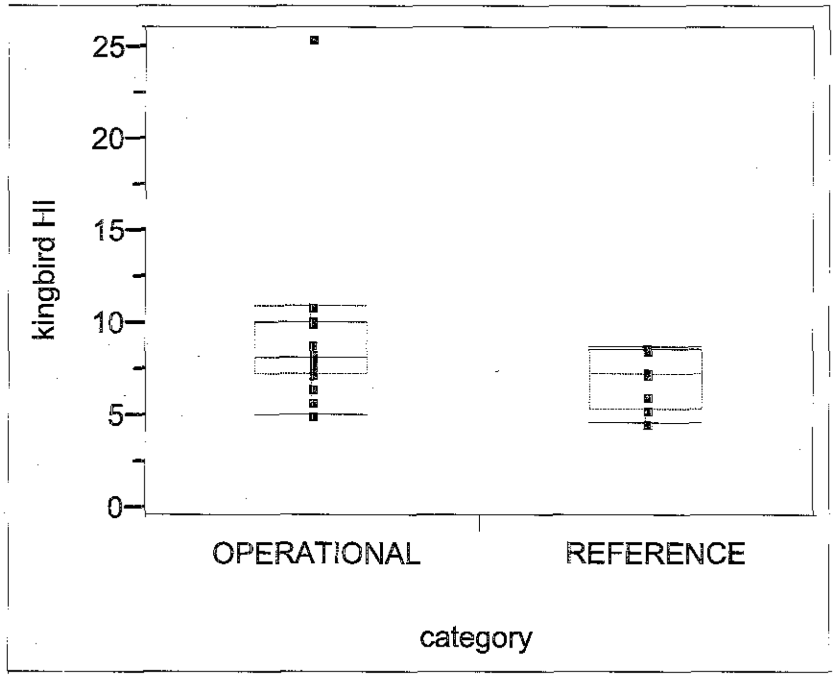


Figure 6-49b. Hazard Indices for Near-Shore Kingbirds Grouped by Individual Sites.

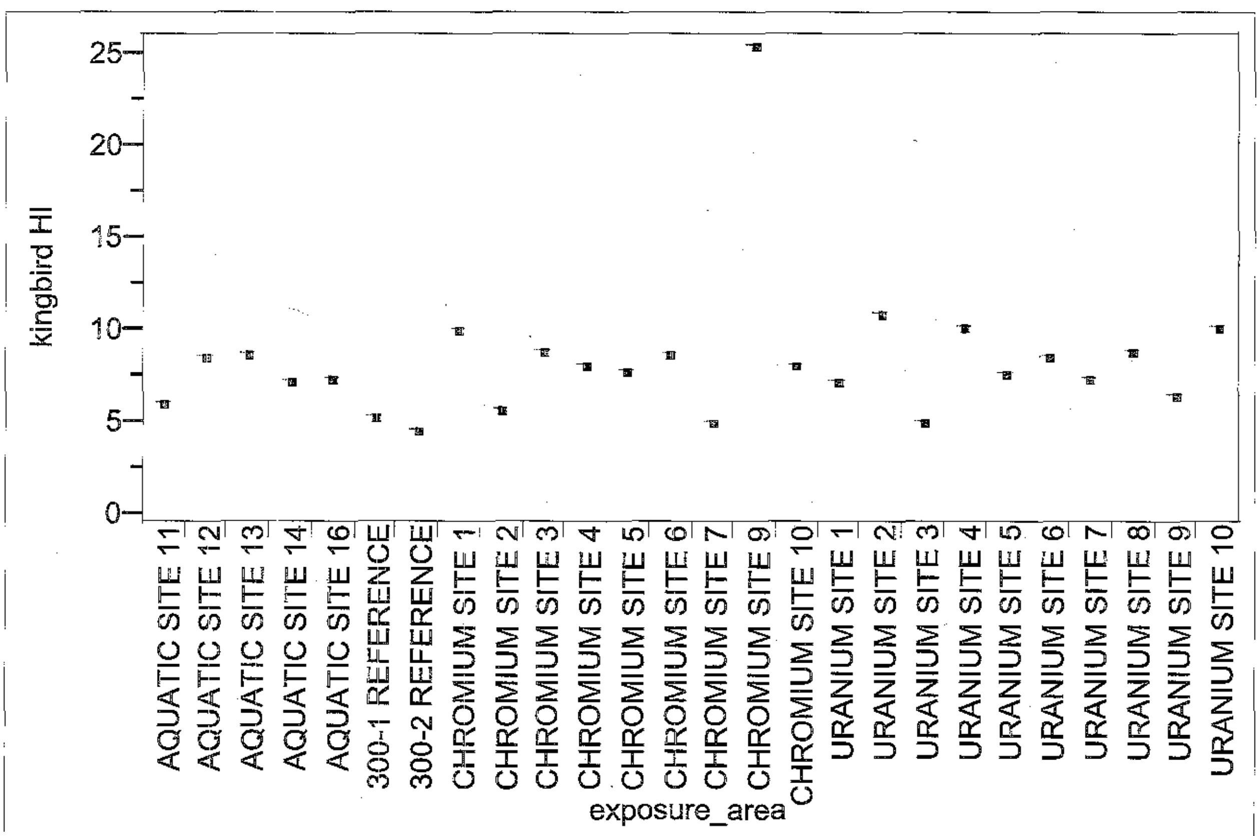


Figure 6-50a. Hazard Indices for Near-Shore Bufflehead Grouped by Category.

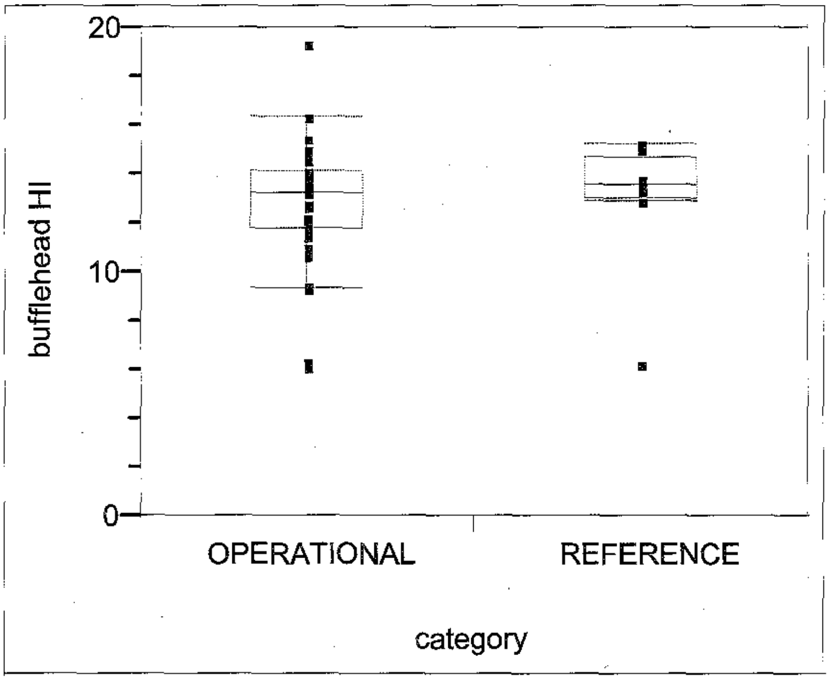


Figure 6-50b. Hazard Indices for Near-Shore Bufflehead Grouped by Individual Sites.

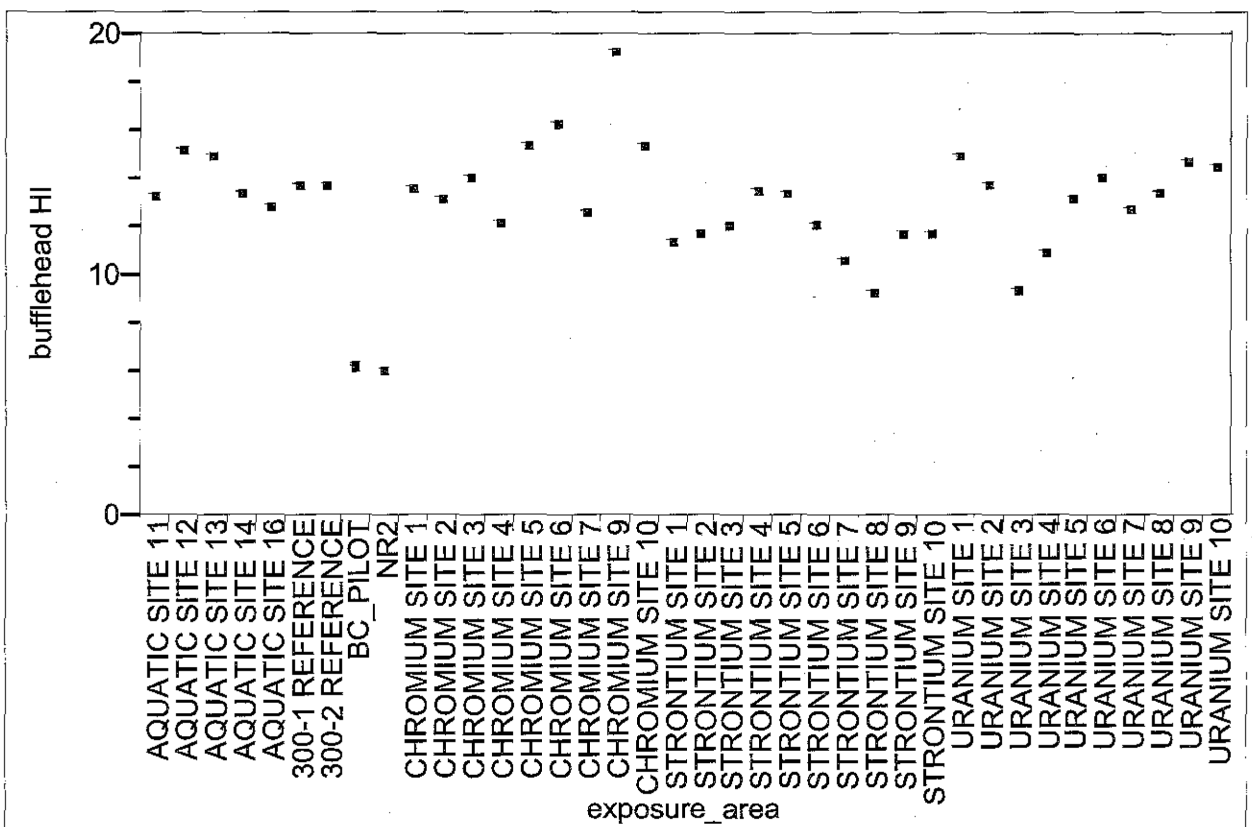


Figure 6-51a. Hazard Indices for Near-Shore Myotis Bat Grouped by Category.

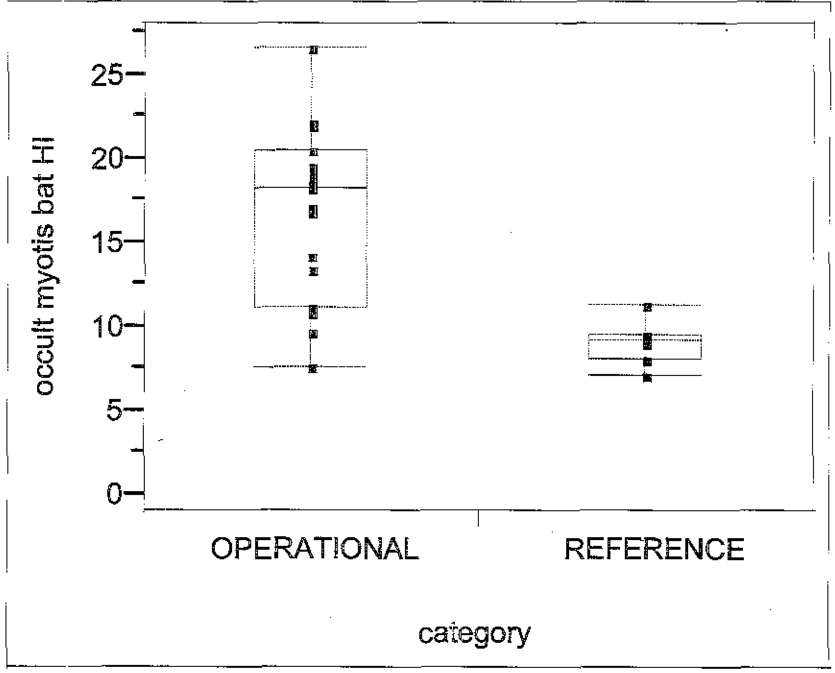


Figure 6-51b. Hazard Indices for Near-Shore Myotis Bat Grouped by Individual Site.

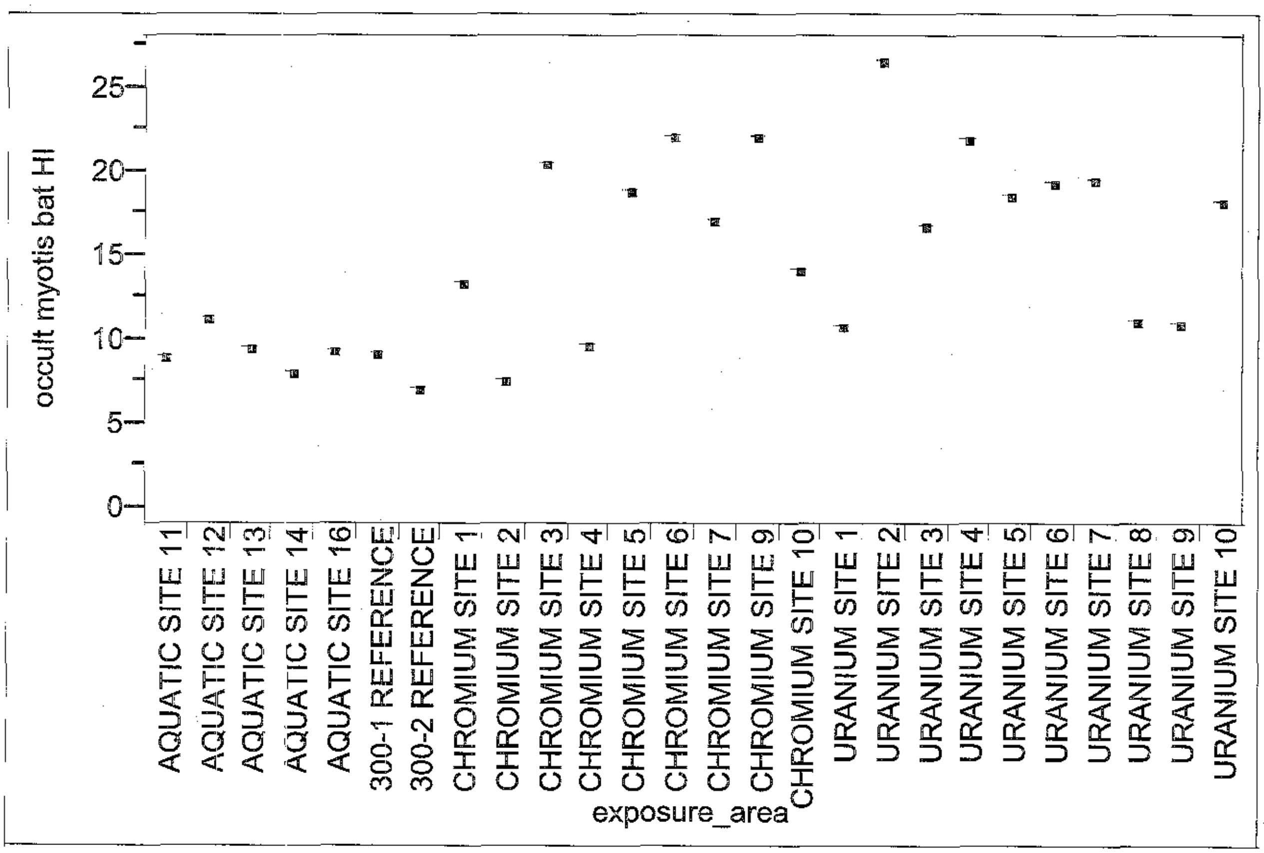


Figure 6-52a. Hazard Indices for Near-Shore Great Blue Heron Grouped by Category.

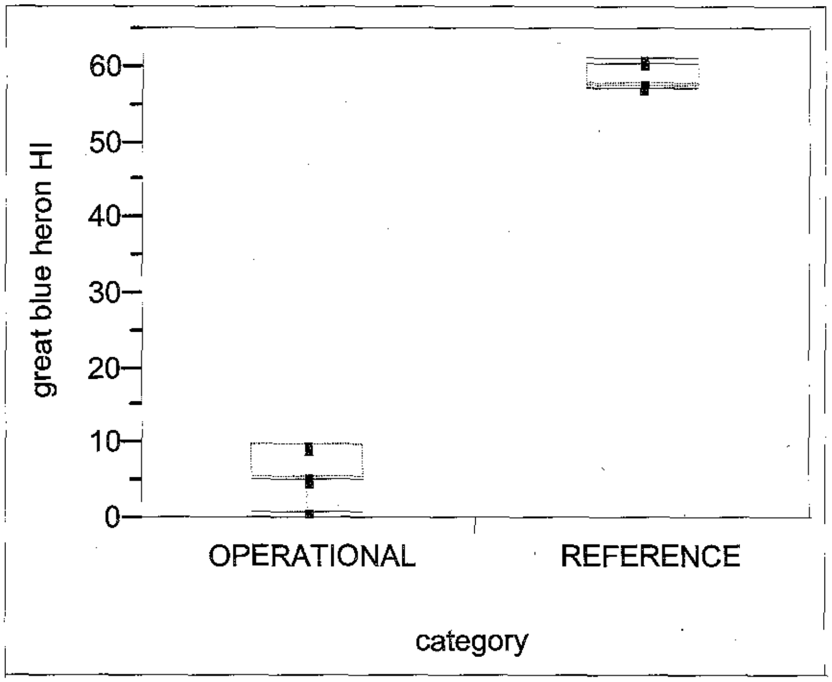


Figure 6-52b. Hazard Indices for Near-Shore Great Blue Heron Grouped by Individual Site.

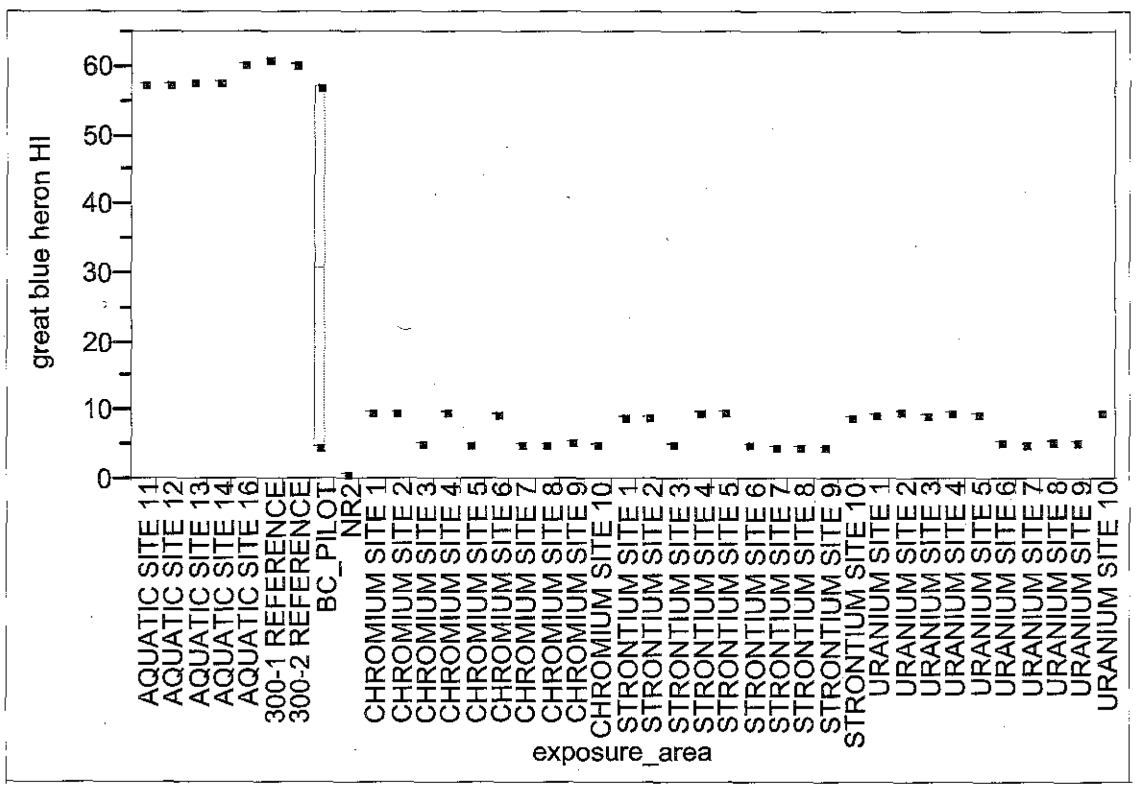


Figure 6-53a. Hazard Indices for Near-Shore Red-Tailed Hawk Grouped by Category.

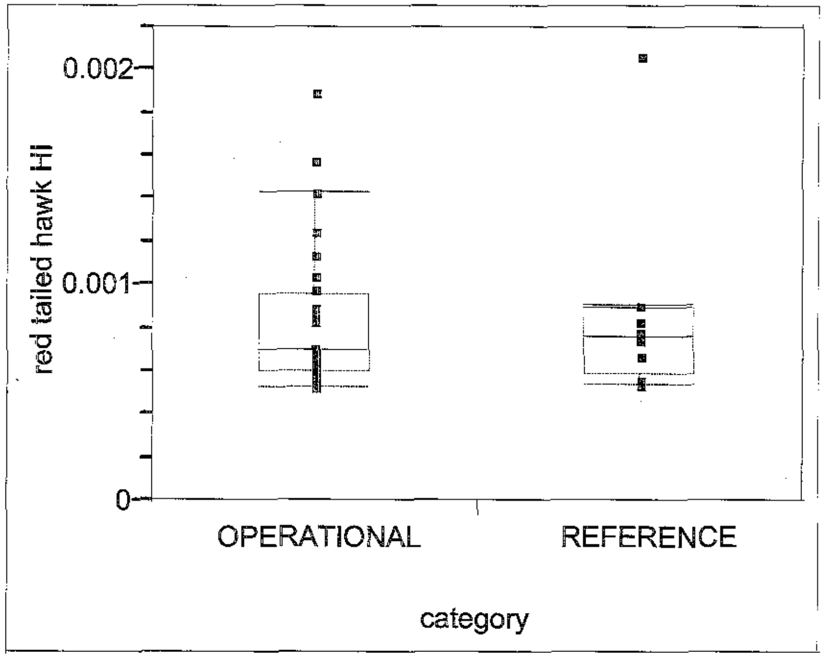


Figure 6-53b. Hazard Indices for Near-Shore Red-Tailed Hawk Grouped by Individual Site.

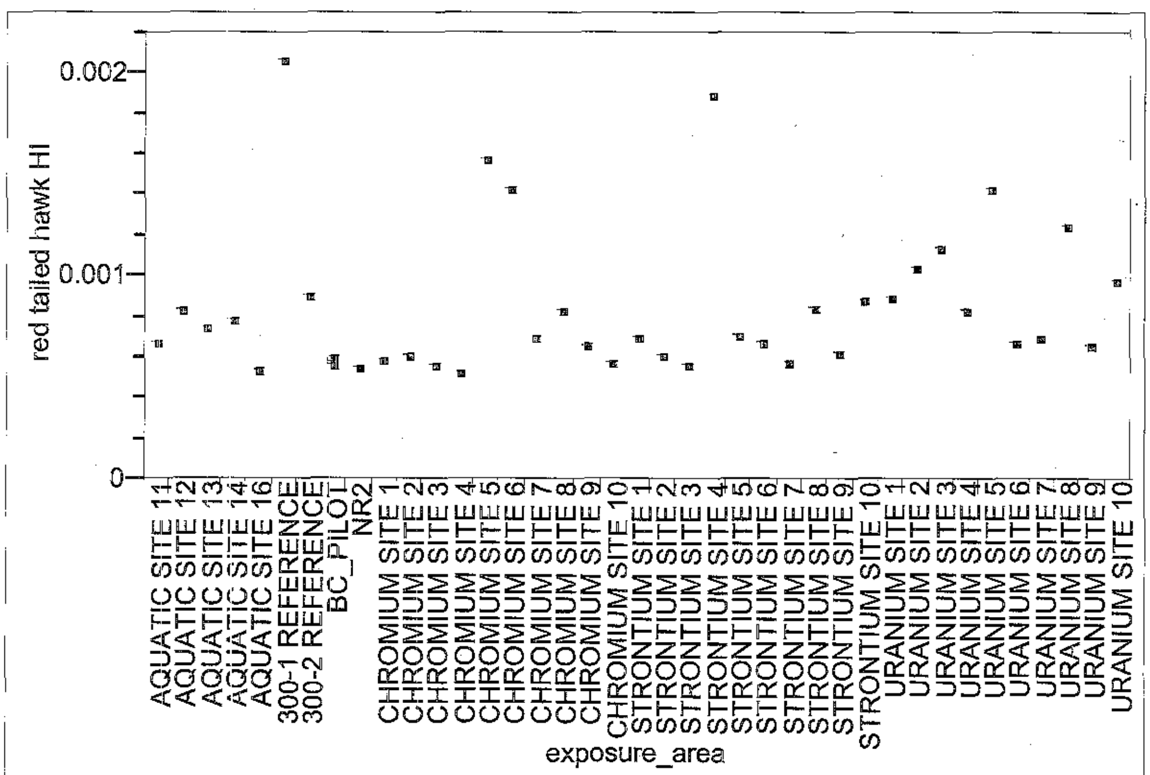


Figure 6-54a. Hazard Indices for Near-Shore Badger Grouped by Category.

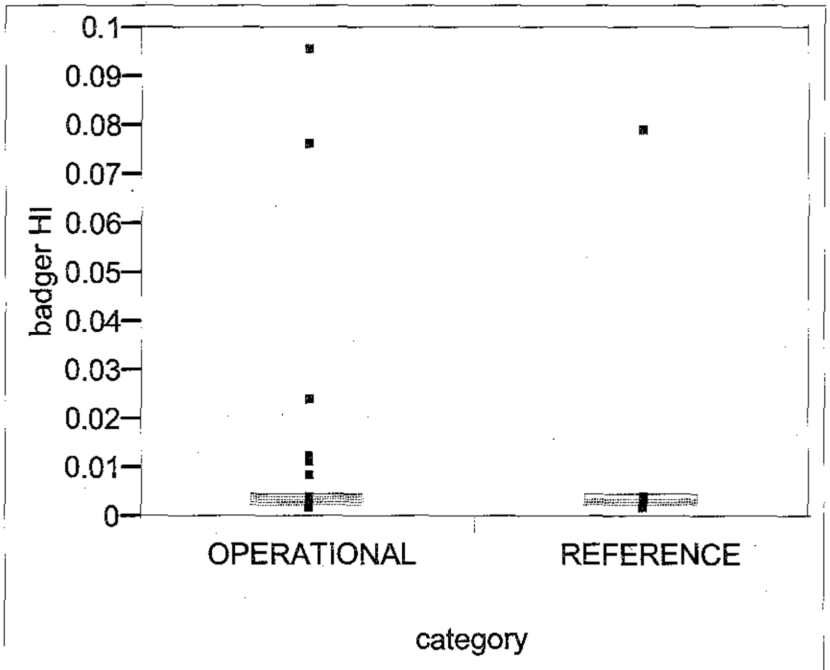


Figure 6-54b. Hazard Indices for Near-Shore Badger Grouped by Individual Site.

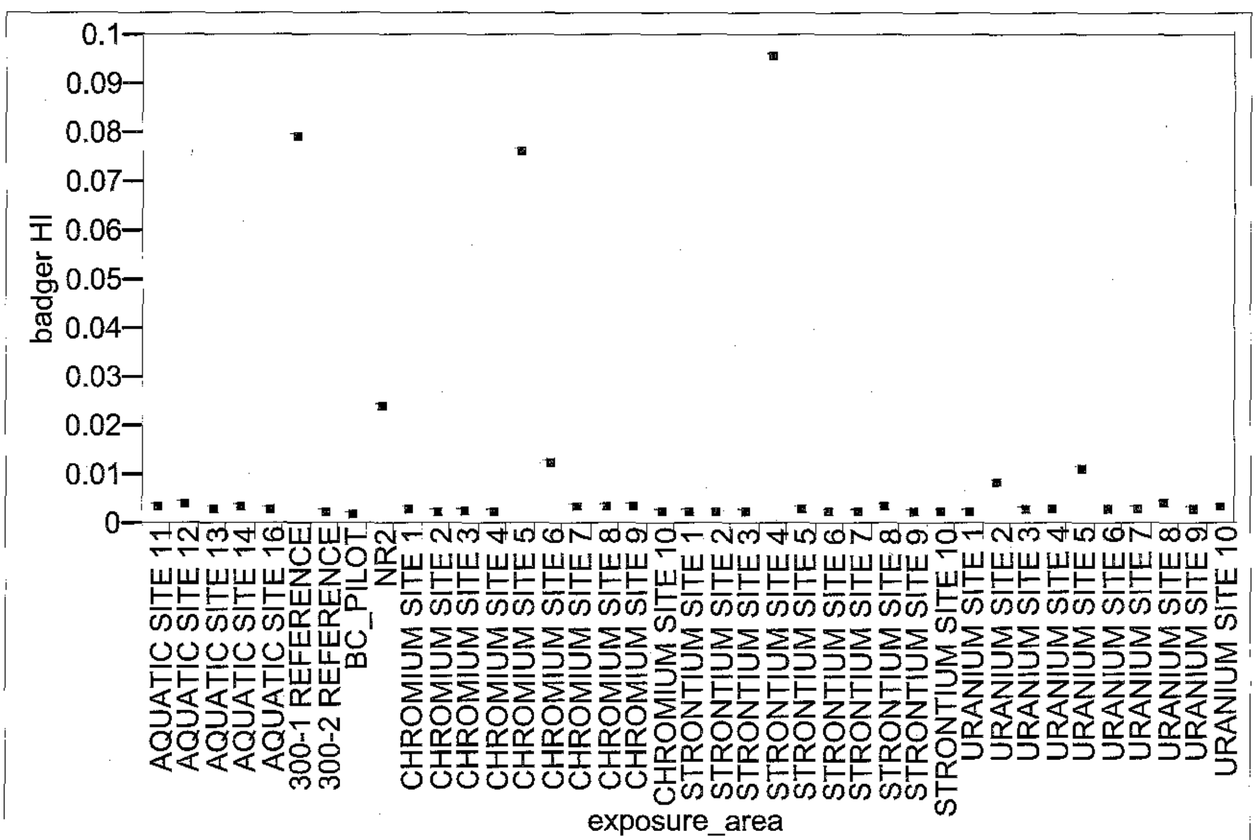


Figure 6-55a. Sculpin *(Cottus spp.)* Length Plotted by Hanford River Mile (HRM).

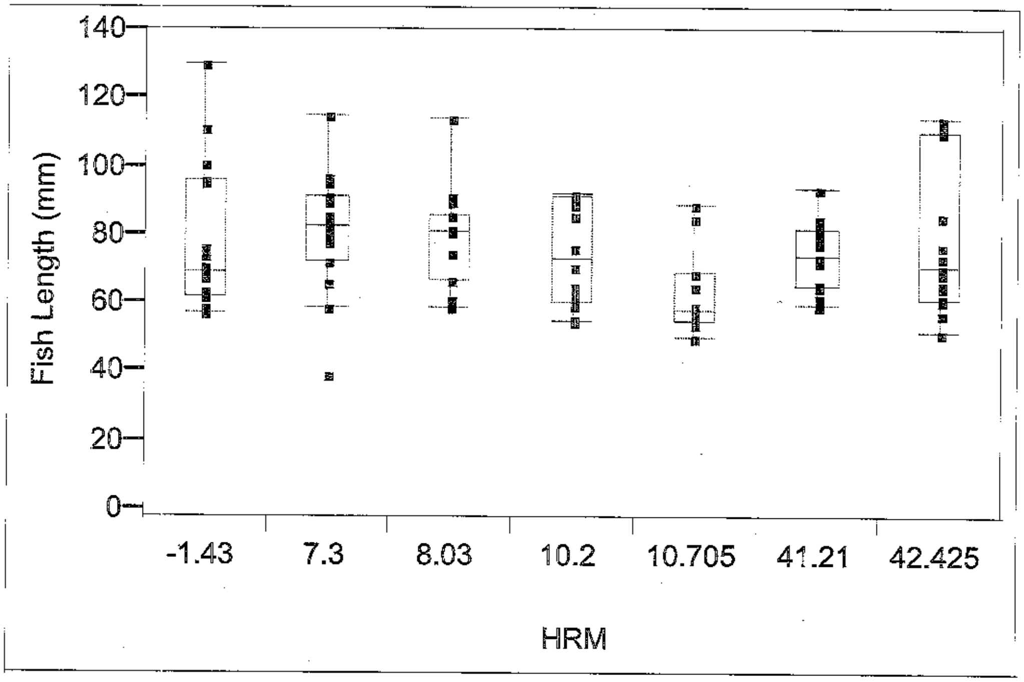


Figure 6-55b. Sculpin *(Cottus spp.)* Weight Plotted by Hanford River Mile (HRM).

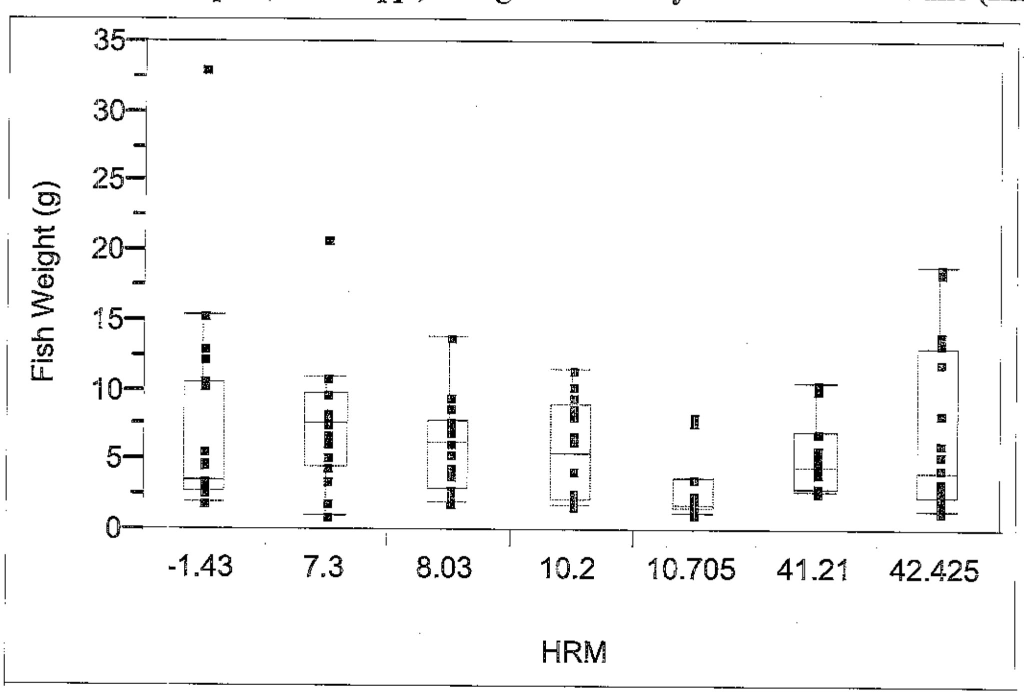
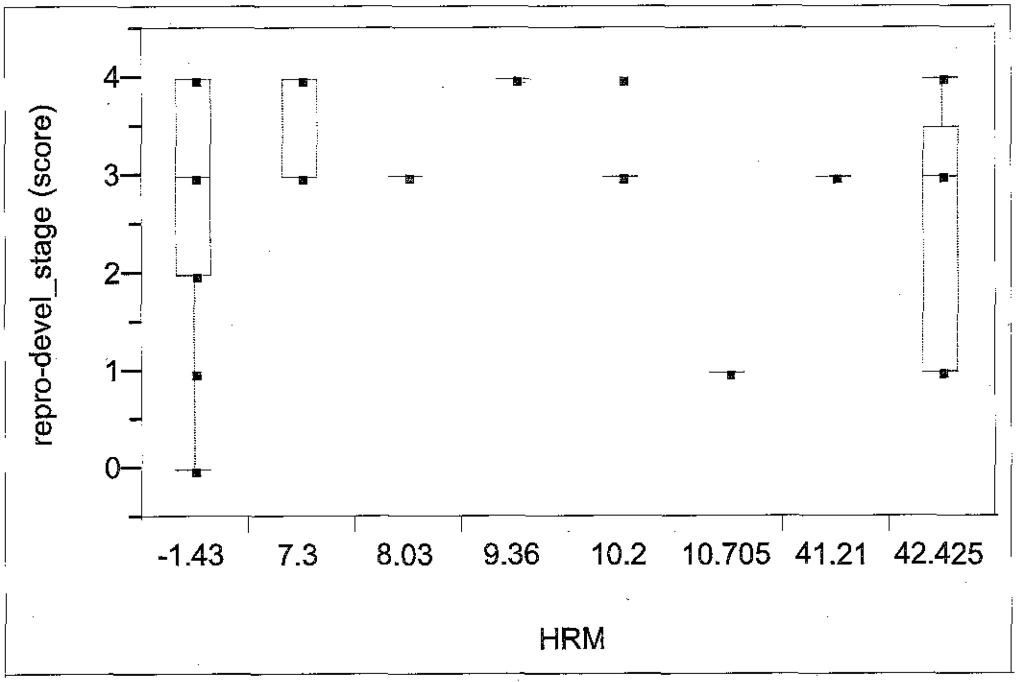


Figure 6-55c. Reproductive Developmental Stage for Female *Cottus* spp Plotted by Hanford River Mile (HRM).



Lower scores indicate less reproductively mature fish.

Figure 6-55d. Sculpin *(Cottus spp.)* Liver Parasites Plotted by Hanford River Mile (HRM).

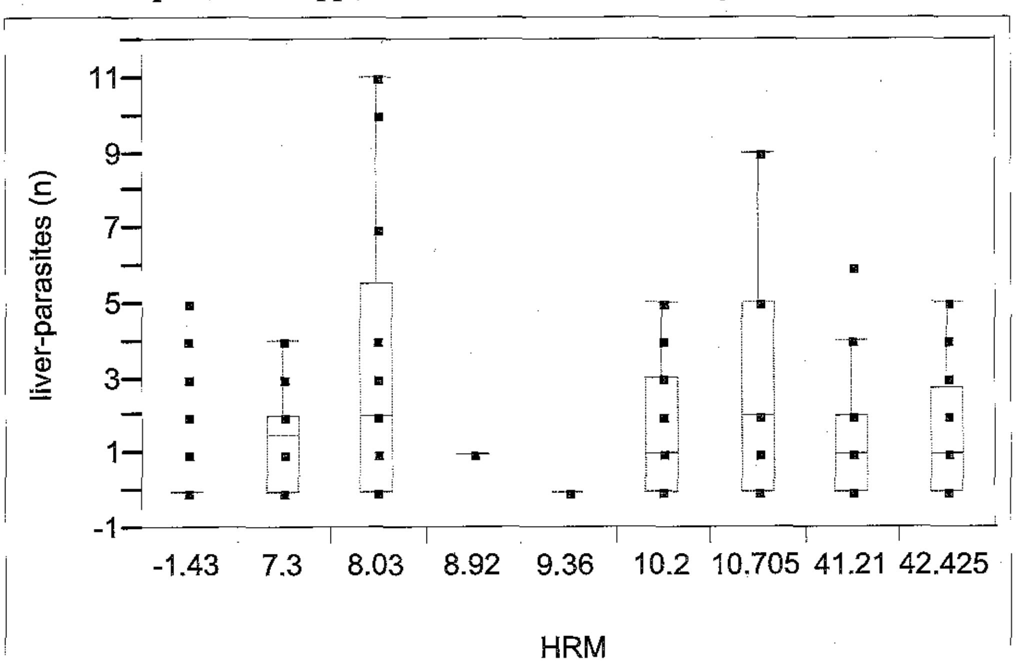


Table 6-1a. Exposure Models for Upland Assessment Endpoints.

Receptor	Trophic Category	Exposure Model
Plant	Producer	$E_{dermal} = C_{soil}$
Plant BCG	Producer	$E_{dermal} = C_{soil}$
Invertebrate	General	$E_{dermal} = C_{soil}$
Wildlife BCG	General	$E_{dermal} = C_{soil}$
Pocket Mouse	Herbivore	$E_{oral} = C_{soil} \cdot I_{soil} + C_{plant} \cdot I_{plant}$
Mourning Dove	Herbivore	$E_{oral} = C_{soil} \cdot I_{soil} + C_{plant} \cdot I_{plant}$
Deer Mouse	Omnivore	$E_{oral} = C_{soil} \cdot I_{soil} + C_{plant} \cdot I_{plant} + C_{terrestrial\_invertebrate} \cdot I_{terrestrial\_invertebrate}$
Meadowlark	Omnivore	$E_{oral} = C_{soil} \cdot I_{soil} + C_{plant} \cdot I_{plant} + C_{terrestrial\_invertebrate} \cdot I_{terrestrial\_invertebrate}$
Grasshopper Mouse	Insectivore	$E_{oral} = C_{soil} \cdot I_{soil} + C_{terrestrial\_invertebrate} \cdot I_{terrestrial\_invertebrate}$
Killdeer	Insectivore	$E_{oral} = C_{soil} \cdot I_{soil} + C_{terrestrial\_invertebrate} \cdot I_{terrestrial\_invertebrate}$
Badger	Carnivore	$E_{oral} = C_{soil} \cdot I_{soil} + C_{water} \cdot I_{water} + C_{small\_mammal} \cdot I_{small\_mammal}$
Red-tailed Hawk	Carnivore	$E_{oral} = C_{soil} \cdot I_{soil} + C_{water} \cdot I_{water} + C_{small\_mammal} \cdot I_{small\_mammal}$

Notes:

COPCs in soil and biotic media (plants, terrestrial invertebrates and small mammals) are specific to terrestrial upland sites. It is assumed that receptors in the highest trophic level, badger and red-tailed hawk, are able to access and drink surface water from the river and thus represent multi-media exposure. Representative surface water concentrations are based on the COPC-specific means from each operational area and from reference sites.

BCG = biota concentration guide

COPC = contaminant of potential concern

Table 6-1b. Exposure Models for Riparian Assessment Endpoints.

Receptor	Trophic Category	Exposure Model
Plant	Producer	$E_{dermal} = C_{soil}$
Plant BCG	Producer	$E_{dermal} = C_{soil}$
Invertebrate	General	$E_{dermal} = C_{soil}$
Wildlife BCG	General	$E_{dermal} = C_{soil}$
Pocket Mouse	Herbivore	$E_{oral} = C_{soil} \cdot I_{soil} + C_{plant} \cdot I_{plant}$
Mourning Dove	Herbivore	$E_{oral} = C_{soil} \cdot I_{soil} + C_{plant} \cdot I_{plant}$
Deer Mouse	Omnivore	$E_{oral} = C_{soil} \cdot I_{soil} + C_{plant} \cdot I_{plant} + C_{terrestrial\_invertebrate} \cdot I_{terrestrial\_invertebrate}$
Meadowlark	Omnivore	$E_{oral} = C_{soil} \cdot I_{soil} + C_{plant} \cdot I_{plant} + C_{terrestrial\_invertebrate} \cdot I_{terrestrial\_invertebrate}$
Grasshopper Mouse	Insectivore	$E_{oral} = C_{soil} \cdot I_{soil} + C_{terrestrial\_invertebrate} \cdot I_{terrestrial\_invertebrate}$
Kingbird	Insectivore	$E_{oral} = C_{water} \cdot I_{water} + C_{soil} \cdot I_{soil} + C_{terrestrial\_invertebrate} \cdot I_{terrestrial\_invertebrate}$
Killdeer	Insectivore	$E_{oral} = C_{soil} \cdot I_{soil} + C_{terrestrial\_invertebrate} \cdot I_{terrestrial\_invertebrate}$
Badger	Carnivore	$E_{oral} = C_{soil} \cdot I_{soil} + C_{water} \cdot I_{water} + C_{small\_mammal} \cdot I_{small\_mammal}$
Red-tailed Hawk	Carnivore	$E_{oral} = C_{soil} \cdot I_{soil} + C_{water} \cdot I_{water} + C_{small\_mammal} \cdot I_{small\_mammal} + C_{bird} \cdot I_{bird}$

Notes:

COPCs in soil and biotic media (plants, terrestrial invertebrates, kingbirds and small mammals) are specific to terrestrial riparian sites. In addition to kingbirds drinking river water, it is assumed that receptors in the highest trophic level are able to access and drink surface water from the river and thus represent multi-media exposure. Representative kingbird tissue concentrations are based on zones where kingbirds were collected.

BCG = biota concentration guide

COPC = contaminant of potential concern

Table 6-1c. Exposure Models for Near-Shore Assessment Endpoints.

Receptor	Trophic Category	Exposure Model
Aquatic biota	General	$E_{dermal} = C_{water}$
Water BCG	General	$E_{dermal} = C_{water}$
Sediment biota	General	$E_{dermal} = C_{sed}$
Sediment BCG	General	$E_{dermal} = C_{sed}$
Myotis bat	Insectivore	$E_{oral} = C_{sed} \cdot I_{sed} + C_{benthic\_macroinvertebrate} \cdot I_{benthic\_macroinvertebrate}$
Bufflehead	Invertivore	$E_{oral} = C_{water} \cdot I_{water} + C_{sed} \cdot I_{sed} + C_{benthic\_macroinvertebrate} \cdot I_{benthic\_macroinvertebrate} + C_{clam} \cdot I_{clam}$
Kingbird	Insectivore	$E_{oral} = C_{water} \cdot I_{water} + C_{benthic\_macroinvertebrate} \cdot I_{benthic\_macroinvertebrate}$
Great Blue Heron	Piscivore	$E_{oral} = C_{water} \cdot I_{water} + C_{benthic\_macroinvertebrate} \cdot I_{benthic\_macroinvertebrate} + C_{fish} \cdot I_{fish}$
Badger	Carnivore	$E_{oral} = C_{water} \cdot I_{water}$
Red-tailed Hawk	Carnivore	$E_{oral} = C_{water} \cdot I_{water} + C_{bird} \cdot I_{bird}$

Notes: COPCs in sediment and surface water and biotic media (benthic macroinvertebrates, clams, sculpin) are specific to near-shore sites. Considering the clam and benthic macroinvertebrate diet characteristic of bufflehead ducks, this receptor was used as a maximally-exposed surrogate for the herbivorous mallard.

BCG = biota concentration guide

COPC = contaminant of potential concern

Table 6-2. Mammals Collected in RCBRA Sampling Campaign.

Common Name	Species Name	% of Total
California vole	*Microtus montanus*	0.3
Bushy-tailed woodrat	*Neotoma cinerea*	0.3
House mouse	*Mus musculus*	0.3
Deer mouse	*Peromyscus maniculatus*	52.8
Great Basin pocket mouse	*Perognathus parvus*	42.2
Western harvest mouse	*Reithrodontomys megalotus*	4.0

Table 6-3. Kingbird Nest Success.

Total nests identified	41
Nests predated by crows and ravens [a]	12
Nests abandoned [b]	12
Occupied [c]	4
Nests from which fledglings collected [d]	9
Percent nests successfully harvested	21%

[a] Eggs are missing or shells are broken open and no juvenile birds are observed, chorionic membrane attached to shell.

[b] Eggs are present but no adults defending nest site

[c] Birds tending nest and defending territory but no eggs or chicks are present

[d] Fledglings collected for tissue analyses

Table 6-4. Lines of Evidence for Terrestrial Assessment Endpoints. (3 Pages)

Assessment Endpoint	Attributes	Terrestrial Hypotheses	Weight	Conclusions
Plants	Literature values for survival, growth, or reproduction	Mean waste/operational site soil contaminant concentrations are not greater than soil benchmarks relative to reference sites	Low	While plant hazard indices are elevated, they are uniformly distributed across terrestrial site types, are not statistically different among sites, and are primarily the result of constituents normally present in soil, indicating that literature-extrapolated risks to plants are based on constituents present at background levels and are unrelated to Hanford Site operations
	Diversity and abundance from plant surveys	Waste/operational site species diversity and population abundance are not less than at reference sites and do not decrease along an increasing contamination gradient	Med	Riparian sites had the highest diversity richness and cover among all sites, had special status species were identified at operational riparian sites, and did not differ significantly between operational and reference areas. Overall, diversity, species richness and total cover at upland (remediated backfilled and native soil) and riparian terrestrial sites are not significantly different than at corresponding reference sites.
	Measured tissue concentrations	Mean waste/operational site tissue contaminant concentrations are not greater than at reference sites and do not increase along an increasing contamination gradient	NA	There were no statistically significant correlations between contaminants in plants and soil across all sites.
	Survival, growth from toxicity testing	Mean waste/operational site survival and growth is not less than at reference sites and does not decrease along an increasing contamination gradient	High	There were no differences in Sandberg's bluegrass among terrestrial sites. However, issues with laboratory record-keeping cast the validity of these results in question and these results will not be used in making conclusions of risk to terrestrial plants.
Soil biota	Literature values for survival, growth or reproduction	Mean waste/operational site soil contaminant concentrations are not greater than soil benchmarks relative to reference sites	Low	While soil invertebrate hazard indices are elevated above one, they are not statistically different among sites and are primarily the result of exceeding benchmarks for constituents normally present in soil. This indicates that literature-extrapolated risks to soil invertebrates are not related to Hanford Site operations.

Table 6-4. Lines of Evidence for Terrestrial Assessment Endpoints. (3 Pages)

Assessment Endpoint	Attributes	Terrestrial Hypotheses	Weight	Conclusions
	Diversity and abundance from pitfall traps	Waste/operational site species diversity and population abundance are not less than at reference sites and do not decrease along an increasing contamination gradient	Med	Soil biota diversity and abundance estimates are compromised because, given insufficient biomass, additional invertebrates (primarily beetles) were hand collected, thus biasing estimates of relative abundance as represented by passive collection in pitfall traps. Consequently, this line of evidence will not be used to make conclusions of risk to soil invertebrates.
	Measured tissue concentrations	Mean waste/operational site tissue contaminant concentrations are not greater than at reference sites and do not increase along an increasing contamination gradient	NA	There were no statistically significant correlations between contaminants in soil biota and soil across all sites.
	Survival from toxicity testing	Mean waste/operational site survival and growth is not less than at reference sites and does not decrease along an increasing contamination gradient	High	Nematode survival in riparian soils was significantly lower than survival in upland soils but there were no differences between waste/operational site and reference site survival, indicating that soil invertebrates are not adversely affected by contamination from Hanford Site operations.
Middle trophic-level species	Literature values for survival, growth or reproduction compared to modeled exposure	Dietary exposure modeled from waste/operational sites is not greater than toxicity reference values relative to exposure modeled from reference sites	Low	Modeled exposure was compared to literature-based toxicity reference values for herbivores (mourning dove, pocket mouse), omnivores (meadowlark, deer mouse) and insectivores (killdeer, grasshopper mouse). Hazard indices for all receptors were not statistically significantly higher between upland waste and riparian operational sites and paired reference sites, indicating that modeled exposure and associated potential risks are unrelated to Hanford Site operations.
	Measured tissue concentrations	Mean tissue contaminant concentrations at waste/operational sites are not greater than at reference sites and do not increase along an increasing contamination gradient	Med	There were no statistically significant correlations between contaminants in soil and small mammal liver/kidney, small mammal carcass and kingbird tissues across terrestrial sites. Tissue effects levels were not exceeded in operational soils.

Table 6-4. Lines of Evidence for Terrestrial Assessment Endpoints. (3 Pages)

Assessment Endpoint	Attributes	Terrestrial Hypotheses	Weight	Conclusions
	Balanced gender ratios, juvenile recruitment, relative abundance from small mammal field studies	Relative population abundance, reproduction rates, equality of gender ratios and juvenile recruitment at waste/operational sites is not less than at references and does not decrease along an increasing contamination gradient	Med	Small mammal population characteristics such as relative population abundance and total numbers trapped differed significantly among sites in only a few instances and these differences are likely based on aspects of the plant community. For example, although heavy metals were most elevated in riparian areas, which would be expected to depress abundance and reproductive output, the riparian operational soils had the richest plant communities and highest numbers of mammals captured and significantly higher proportions of reproductively active females. And although small mammal gender ratios deviated from equality, with more males than females captured at all sites, there were no significant differences in the ratio of females to males among waste/operational sites and reference sites. These observations suggest that aspects of small mammal populations, such as inequities in gender ratio, and differences in parameters among sites cannot be attributed to past Hanford Site operational releases.
Carnivorous birds and mammals	Literature values for survival, growth or reproduction compared to modeled exposure	Dietary exposure modeled from waste/operational sites is not greater than toxicity reference values relative to exposure modeled from reference sites	Low	Hazard indices for red-tailed hawks consuming soil, surface water and small mammals and birds are below one suggesting low potential for risk. In addition, HIs are not statistically significantly higher at upland waste and riparian operational sites relative to paired reference sites. This indicates that modeled exposure to red-tailed hawks from waste/operational sites is associated with de minimus risk. HIs for the badger are above one and based primarily on thallium in the diet. The thallium TRV is highly uncertain because few toxicological data exist; it is therefore extremely conservative. In addition, badger HIs at operational and waste sites are not significantly different from paired reference sites. This indicates that modeled exposure to badger and associated potential risks are not related to Hanford Site operations.

Low = hypothesis has low weight
Med = hypothesis has medium weight
High = hypothesis has high weight
NA = Not applicable to the endpoint in question given dearth of information linking measured tissue concentration to effects on that endpoint.

Table 6-5. RCBRA Clam Histopathology and Clinical Condition Results.

Corbicula Endpoint	Significant*
Clinical condition: gaping, tissue condition precludes histology	No
Digestive tubular epithelial cell height: indication of active metabolism and ingestion	No
Digestive tubular epithelial cell shedding: loss of digestive tubular epithelial cells	Yes, higher at operational areas
Digestive System Hemocytosis: an inflammatory response typically found around the conducting tubules of the digestive gland	No
Absorptive cells vacuolation: vacuoles observed in epithelial absorptive cells of the digestive tubules	No
Reproductive system ovary condition assessed to indicate normal vitellogenic oocytes within follicles and to indicate abnormal appearing oocytes with ruptured or fused membranes (syncytium)	No
Connective tissue hemocytosis: indicates the degree of accumulation of hemocytes in connective tissues	No
Mantle epithelium tissue was evaluated and scored as normal, or with focal to multifocal necrosis and loss of mantle epithelium, or as extensive necrosis with loss of mantle epithelium	No
Gills - Epithelial cell shedding: indicates the loss of gill epithelial cells	No
Gill hemocytosis: an inflammatory response in clam gills.	No
Gills – Larvae: indicates the presence and condition of larvae brooding in clam gill tissue	No
Kidney: rated as normal or with focal loss or necrosis of kidney epithelial cells or focal necrosis of kidney cells with hemocytosis	No
Adductor muscle lesions	No
Foot musculature and epithelium lesions	No
Nerves/ganglia lesions	No
Gender: female, male, or hermaphrodite	NA
Stage of development of reproductive follicles and tubules	No
Maximum anterior-posterior shell length	No
Hyaline degenerate follicles: reproductive follicles that may represent fusion and degeneration of nuclear material from unspawned reproductive products	No
Number of reproductive system follicle cysts -- a fibrous reaction around and within reproductive follicles	Yes, higher at reference areas
Reproductive System Necrotic Ducts (count)	No

* Significant difference (alpha = 0.05) between operational and reference site observations. Sample size ranged from 132 observations (kidney) and between and 231 to 235 observations for all other measures

NA = not applicable

Table 6-6a. Aquatic Benthic Macroinvertebrate Community Metrics for Reference Site Stations.

ATTRIBUTES	Ref 11	Ref 12	Ref 13	Ref 14	Ref 16	Ref 300-1	Ref 300-2
INDICES							
Hilsenhoff Index	7.11	7.55	6.22	6.37	6.93	6.7	6.6
MEASURES							
Total Invertebrate Abundance	104	671	628	410	386	314	335
Number of Invertebrate Taxa	26	25	19	12	28	28	36
Total Diversity (H)	3.55	2.95	2.04	2.29	3.54	2.98	3.1
Number of Molluska Taxa	7	6	4	2	8	8	8
Abundance of Molluska Taxa	14	16.8	12.6	13	80.2	31.3	10.8
Number of Rare Molluska Taxa	1	1	1	0	1	1	1
Molluska Diversity (H)	1.88	1.40	0.66	0.21	0.96	0.90	1.64
Abundance of Crustacea	47	226.2	2.6	18.1	85.7	15.3	23
Number of Crustacea Taxa	6	7	3	4	5	3	4
Abundance of Ephemeroptera	5	2	18	6	11	16	34
Number of Ephemoptera Taxa	3	2	3	5	4	4	4
Abundance of Trichoptera	1	211	220	63	73	120	104
Number of Trichopteran Taxa	3	4	4	4	4	6	8
Abundance of Net-Spinners (Hydropsychidae)	0.3	197	196	27	71	92	82
Abundance of Midges	14	101	349	240	57	125	143
Number of tolerant taxa	17	14	9	12	19	18	38
Tolerant taxa (%)	63	66	14	20	59	22	37

Table 6-6b. Aquatic Benthic Macroinvertebrate Community Metrics for Chromium Plume Stations.

ATTRIBUTES	Cr1	Cr2	Cr3	Cr4	Cr5	Cr6	Cr7	Cr9	Cr10
INDICIES									
Hilsenhoff Index	6.3	6.14	6.45	6.48	6.37	6.85	6.26	6.55	6.5
MEASURES									
Total Invertebrate Abundance	528	265	698	2782	272	1312	5407	6770	7164
Number of Invertebrate Taxa	28	24	27	17	30	23	20	19	20
Total Diversity (H)	1.82	1.54	2.07	1.68	1.99	2.51	1.73	1.99	2.05
Number of Molluska Taxa	7	7	5	2	7	3	6	3	5
Abundance of Molluska Taxa	7.7	5.6	16.3	8.3	10	129.6	108.1	288.7	229.6
Number of Rare Molluska Taxa	0	0	1	0	1	0	2	1	1
Molluska Diversity (H)	1.79	1.86	1.27	0.16	1.75	0.13	1.17	0.68	0.84
Abundance of Crustacea	33.7	11.1	42.4	2.3	20	7.6	0	0.7	16
Number of Crustacea Taxa	5	6	6	2	5	4	0	1	2
Abundance of Ephemeroptera	2	0.3	3	24	6	13	115	75	121
Number of Ephemoptera Taxa	2	1	3	4	5	3	3	3	3
Abundance of Trichoptera	33	24	62	974	31	566	1923	2933	3080
Number of Trichopteran Taxa	6	3	5	4	5	6	5	6	5
Abundance of Net-Spinners (Hydropsychidae)	14	23	49	901	24	426	1845	2835	2931
Abundance of Midges	387	203	454	1685	193	554	3219	3367	3655
Number of tolerant taxa	22	18	22	18	10	20	23	15	18
Tolerant taxa (%)	37	43	46	47	20	32	27	44	49

Table 6-6c. Aquatic Benthic Macroinvertebrate Community Metrics for Uranium Plume Stations.

ATTRIBUTES	U1	U2	U3	U4	U5	U6	U7	U8	U9	U10
INDICES										
Hilsenhoff Index	6.78	6.8	6.77	6.57	6.48	6.38	6.69	6.51	6.6	6.85
MEASURES										
Total Invertebrate Abundance	364	388	567	939	476	402	1242	359	364	255
Number of Invertebrate Taxa	27	34	34	20	35	38	29	30	30	33
Total Diversity (H)	3.13	3.34	2.94	2.46	2.7	2.54	2.79	3.11	2.8	3.41
Number of Molluska Taxa	10	12	18	1	6	8	4	7	9	8
Abundance of Molluska Taxa	84.4	109.2	103.6	10.3	14.1	6.6	45.6	185.9	21.8	40.0
Number of Rare Molluska Taxa	2	2	2	0	1	2	2	1	2	2
Molluska Diversity (H)	1.59	1.44	1.10	0.00	1.29	1.72	0.67	0.85	1.23	0.90
Abundance of Crustacea	20.3	66.3	2	0.7	22.6	11.6	4.9	25.6	48	28
Number of Crustacea Taxa	5	5	5	1	5	5	3	5	5	6
Abundance of Ephemeroptera	18	27	37	168	74	67	212	31	39	20
Number of Ephemoptera Taxa	1	1	5	6	5	5	7	3	2	3
Abundance of Trichoptera	29	28	216	368	94	66	515	39	40	41
Number of Trichopteran Taxa	5	7	8	5	9	8	7	8	6	7
Abundance of Net-Spinners (Hydropsychidae)	18	24	189	346	57	43	469	26	28	31
Abundance of Midges	158	133	202	370	254	230	437	62	181	84
Number of tolerant taxa	19	16	17	16	7	18	13	10	7	11
Tolerant taxa (%)	41	13	7	17	25	17	44	15	29	27

Table 6-7. RCBRA Sculpin Histopathology and Clinical Condition Results.

Cottus Endpoint	Significant*
Fish length	No
Fish weight	No
Number of encysted parasites in gill tissue	Yes, higher at reference areas
Number of encysted parasites (digenetic trematode) in kidney	Yes, higher at reference areas
Number of liver granulomas (inflammation)	Yes, higher at operational areas
Number of fish liver parasites	Yes, higher at operational areas
Number of muscle granulomas (*trematode metacercaria*)	Yes, higher at operational areas
Peritoneal cavity – number of protozoan granulomas	No
Fish reproductive stage	Yes, lower at reference areas
Clubbing and hyperplasia of fish gills	No
Storage fat vacuoles in fish liver	No
Reproductive system – gender	No
Infiltration of connective tissues by lymphocytes	No
Sloughing of tubular epithelial cells of the kidney	No
Coagulation of cells in fish liver	No
Osteitis (inflammation of bone cells) in fish	No
Chondritis (inflammation of cartilage) in fish	No
Endothelialitis (inflammation of the arteries or veins)	No

* Significant difference (alpha = 0.05) between operational and reference site observations. Sample size ranged from 54 (reproductive developmental stage) to 114 - 140 observations for all other measures

Table 6-8. Lines of Evidence for Aquatic Assessment Endpoints. (4 Pages)

Assessment Endpoint	Attributes	Aquatic Hypotheses	Weight	Conclusions
Plants	Survival, growth from sediment toxicity testing	Mean operational site survival and growth is not less than at reference sites and does not decrease along an increasing contamination gradient	High	Survival was not a measurement endpoint for pakchoi grown in sediments. Biomass was not significantly different among chromium, strontium and uranium plume areas and reference sites, suggesting no potential risk to plants.
Benthic macro-invertebrates	Literature values for survival, growth, or reproduction	Mean operational site water and sediment contaminant concentrations are not greater than benchmarks relative to reference sites	Low	HIs for aquatic (using pore water) and sediment biota are not statistically significantly higher between aquatic operational and reference sites, suggesting that potential risks to benthic macroinvertebrates are not related to Hanford Site operations
	Diversity and abundance from rock baskets	Operational site species diversity and population abundance are not less than at reference sites and do not decrease along an increasing contamination gradient	Med	Molluska taxa were studied in particular detail considering the presence of special status species occurring in the Hanford Reach. Molluska diversity and total taxa were not significantly different among sites; the number of rare taxa was significantly greater in stations from the uranium area.
	Clam survival in situ	Mean operational site survival is not less than at reference sites and does not decrease along an increasing contamination gradient	Med	Clam survival was significantly lower in the chromium plume stations. However, a comprehensive assessment of survival relative to contaminant concentrations in all aquatic media did not reveal significant relationships between contaminant concentrations and survival; survival was most highly correlated with sediment particle size.
	Clam histopathology	Operational site histopathological anomalies are not greater than at reference sites and do not increase along an increasing contamination gradient	High	Of the 21 histopathology endpoints measured in clams, one endpoint (epithelial shedding) was significantly greater in aquatic operational areas and one (reproductive follicle cysts) was greater in aquatic reference areas. The remaining 19 endpoints did not differ significantly between operational and reference areas. These findings do not suggest that past Hanford Site releases resulted in adverse effects in clams inhabiting the Hanford Reach.

Table 6-8. Lines of Evidence for Aquatic Assessment Endpoints. (4 Pages)

Assessment Endpoint	Attributes	Aquatic Hypotheses	Weight	Conclusions
	Measured tissue concentrations	Mean operational site tissue contaminant concentrations are not greater than at reference sites and do not increase along an increasing contamination gradient	NA	There were not trends in increased contamination in clam associated with operational areas versus those in reference locations. Tissue effect levels were exceeded only for mercury in clam soft tissues and for selenium in other benthic macroinvertebrates; exceedances for both COPCs occurred in locations upstream and downstream of Hanford operations.
	Survival and growth from toxicity testing	Mean operational site survival and growth is not less than at reference sites and does not decrease along an increasing contamination gradient	High	Pore water was not toxic with regard to Ceriodaphnia survival and reproductive output. Hyalella had significantly lower survival and growth in sediments from the chromium plume. However, depressed growth and survival were not correlated with any contaminants in aquatic media, suggesting that potential risks to benthic macroinvertebrates are not related to Hanford Site operations.
Amphibians	Measured tissue concentrations	Mean operational site tissue contaminant concentrations are not greater than at reference sites and do not increase along an increasing contamination gradient	Med	Amphibians were targeted for collection in this assessment but field efforts were unsuccessful in gathering animals for analyses. This line of evidence was consequently unavailable for use in an assessment of risk to amphibians.
	Survival and growth based on toxicity testing	Mean operational site survival and growth is not less than at reference sites and does not decrease along an increasing contamination gradient	High	Based on average results per site, survival in pore water from chromium and strontium plume stations is slightly yet significantly reduced for Xenopus embryos mean survival in reference, chromium and strontium pore water is 99.7%, 98% and 97%, respectively. There were no differences in deformities among the sites but growth was statistically significantly reduced in pore water from the strontium plume stations. It is important to note that while these slight differences were statistically significant.

Table 6-8. Lines of Evidence for Aquatic Assessment Endpoints. (4 Pages)

Assessment Endpoint	Attributes	Aquatic Hypotheses	Weight	Conclusions
Consumers (invertivores, piscivores)	Literature values for survival, growth, or reproduction compared to modeled exposure	Dietary exposure modeled from operational sites is not greater than toxicity reference values relative to exposure modeled from reference sites	Low	HIs for kingbirds and buffleheads ingesting water, sediment, clams and benthic macroinvertebrates are not different among aquatic operational sites and reference sites. HIs for great blue heron ingesting fish were significantly higher at reference sites. This indicates that modeled exposure to invertivorous and piscivorous birds and associated potential risks are not related to Hanford Site operations. HIs for bats are significantly higher in aquatic operational sites and the paired reference sites. This indicates that modeled exposure to myotis bats and associated potential risks could be related to Hanford Site operations.
	Measured tissue concentrations	Mean operational site tissue contaminant concentrations are not greater than at reference sites and do not increase along an increasing contamination gradient	Med	There were no trends in increased contamination in fish associated with operational areas versus those in reference locations. Tissue effect levels were exceeded for cadmium, chromium and selenium in fish tissues in locations both upstream and downstream of Hanford operations; the silver effect level was exceeded in one sample near the 100 N area.
	Fish histopathology	Operational site histopathological anomalies are not greater than at reference sites and do not increase along an increasing contamination gradient	High	Observations regarding organ systems likely to be affected by heavy-metal contamination indicate that statistically significant differences occur in both operational (liver) and reference (kidney, gill) areas. There is no clear indication of an impact of past Hanford Site operational releases on fish histopathology.

Table 6-8. Lines of Evidence for Aquatic Assessment Endpoints. (4 Pages)

Assessment Endpoint	Attributes	Aquatic Hypotheses	Weight	Conclusions
	Balanced gender ratios, juvenile recruitment, relative abundance	Relative population abundance, reproduction rates, equality of gender ratios and juvenile recruitment at waste/operational sites is not less than at references and does not decrease along an increasing contamination gradient	Med	Reproductive output in fish is associated with size, with larger fish representing more sexually-mature and reproductively capable individuals. There were no differences in sculpin weight or length between those collected in operational areas relative to reference sites. Reproductive output would be lower for less sexually-mature fish. On this basis, fish in operational areas are expected to be at least as prolific as fish in reference areas because the former represent a life stage with greater reproductive potential.

Low = hypothesis has low weight
Med = hypothesis has medium weight
High = hypothesis has high weight
NA = Not applicable to the endpoint in question given dearth of information linking measured tissue concentration to effects on that endpoint.

Table 6-9. Qualitative Uncertainty Analysis for Terrestrial Assessment Endpoints. (7 Pages)

Assessment Endpoint	Attributes	Terrestrial Hypotheses	Weight	Conclusions
Plants	Literature values for survival, growth, or reproduction	Mean waste/operational site soil contaminant concentrations are not greater than soil benchmarks relative to reference sites	Low	Use of literature toxicity reference values involves uncertainty in the extrapolation from dose response in test organisms to species occurring onsite based on: • Test conditions (e.g., temperature, humidity) • Laboratory toxicity studies are typically focused on a single contaminant whereas conditions in the field typically involve contaminant mixtures • Bioavailability (laboratory studies typically represent maximum bioavailability whereas conditions in the field, such as weathering and sorption decrease bioavailability over time) • Toxic form (valence, etc.) • Relatively short-term laboratory exposure compared to chronic exposure to contaminants in the field Similarity in toxic response
	Diversity and abundance from plant surveys	Waste/operational site species diversity and population abundance are not less than at reference sites and do not decrease along an increasing contamination gradient	Med	Although plant sampling was timed to represent the floral communities typical of investigation areas, plant diversity and abundance surveys are based on a snap shot in time and subject to environmental vagaries (e.g., variable precipitation) affecting the community at the time it was recorded. Relative to perennial shrubs, it is expected that annual species will be more affected by seasonal variation.

Table 6-9. Qualitative Uncertainty Analysis for Terrestrial Assessment Endpoints. (7 Pages)

Assessment Endpoint	Attributes	Terrestrial Hypotheses	Weight	Conclusions
	Measured tissue concentrations	Mean waste/operational site tissue contaminant concentrations are not greater than at reference sites and do not increase along an increasing contamination gradient	NA	Tissue concentrations in plants are subject to: • Analytical measurement uncertainties (e.g., detection limits are typically elevated in tissues because of matrix interferences). • Whether above-ground vegetative material represents contaminant concentrations in all plant matrices/compartments (e.g., roots, seeds) • Whether contaminant concentration in the two dominant species represents all plant species in investigation areas
	Survival, growth from toxicity testing	Mean waste/operational site survival and growth is not less than at reference sites and does not decrease along an increasing contamination gradient	High	• An ecologically relevant test species, Sandberg's bluegrass, was chosen to minimize uncertainty in extrapolating effects from plant bioassays to Hanford Site flora. However, laboratory methodological issues preclude making inferences from the Sandberg's bluegrass bioassay results.
Soil biota	Literature values for survival, growth or reproduction	Mean waste/operational site soil contaminant concentrations are not greater than soil benchmarks relative to reference sites	Low	Use of literature toxicity reference values involves uncertainty in the extrapolation from dose response in test organisms to species occurring onsite based on: • Test conditions (e.g., temperature, humidity) • Laboratory toxicity studies are typically focused on a single contaminant whereas conditions in the field typically involve contaminant mixtures • Bioavailability (laboratory studies typically represent maximum bioavailability whereas conditions in the field, such as weathering and sorption decrease bioavailability over time) • Relatively short-term laboratory exposure compared to chronic exposure to contaminants in the field • Similarity in toxic response

Table 6-9. Qualitative Uncertainty Analysis for Terrestrial Assessment Endpoints. (7 Pages)

Assessment Endpoint	Attributes	Terrestrial Hypotheses	Weight	Conclusions
	Diversity and abundance from pitfall traps	Waste/operational site species diversity and population abundance are not less than at reference sites and do not decrease along an increasing contamination gradient	Med	Soil biota diversity and abundance estimates are subject to the following uncertainties: • Ground-dwelling invertebrates caught in pitfall traps or handpicked are representative of the invertebrates eaten by all Hanford-Site invertebrate consuming predators (including aerial insectivores) • Given insufficient biomass collected at some investigation areas, additional invertebrates were collected (primarily beetles) by hand picking them from the soil surface, biasing estimates of relative abundance as represented by passive collection in pitfall cans.
	Measured tissue concentrations	Mean waste/operational site tissue contaminant concentrations are not greater than at reference sites and do not increase along an increasing contamination gradient	NA	Tissue concentrations in soil biota are subject to: • Analytical measurement uncertainties (e.g., detection limits are typically elevated in tissues because of matrix interferences). • Pitfall-collected invertebrate tissues representing contaminant concentrations in all invertebrate matrices/compartments (e.g., flying insects) at investigation areas • Considering the mobility of receptors, whether pitfall-collected invertebrate tissues represent contaminant concentrations for organisms within investigation areas (versus offsite organisms).
	Survival from toxicity testing	Mean waste/operational site survival and growth is not less than at reference sites and does not decrease along an increasing contamination gradient	High	Nematode survival uncertainties include: • Relatively short-term laboratory exposure (24-hr) of test animals extrapolated to site invertebrates chronically exposed to contaminants • Relative sensitivity of assessing COPC effects using survival as the test endpoint • Extent to which nematodes are representative of invertebrates in upland soils.

Table 6-9. Qualitative Uncertainty Analysis for Terrestrial Assessment Endpoints. (7 Pages)

Assessment Endpoint	Attributes	Terrestrial Hypotheses	Weight	Conclusions
Middle trophic-level species	Literature values for survival, growth or reproduction compared to modeled exposure	Dietary exposure modeled from waste/operational sites is not greater than toxicity reference values relative to exposure modeled from reference sites	Low	Use of literature toxicity reference values involves uncertainty in the extrapolation from test organisms to species occurring onsite based on: • Test conditions (e.g., method of contaminant delivery such as oral intubation or via gavage compared to ingestion of contaminated media onsite) • Bioavailability of contaminant (laboratory studies typically represent maximum bioavailability) relative to site-specific bioavailability • Laboratory toxicity studies are typically focused on a single contaminant whereas conditions in the field typically involve contaminant mixtures • Relatively short-term laboratory exposure compared to chronic exposure to contaminants in the field • Similarity in toxic response Uncertainties associated with modeled exposure include • Measuring media (tissue, soil) concentrations • Extent to which modeled intake for representative receptors reflects actual intake for organisms onsite.

Table 6-9. Qualitative Uncertainty Analysis for Terrestrial Assessment Endpoints. (7 Pages)

Assessment Endpoint	Attributes	Terrestrial Hypotheses	Weight	Conclusions
	Measured tissue concentrations	Mean tissue contaminant concentrations at waste/operational sites are not greater than at reference sites and do not increase along an increasing contamination gradient	Med	Tissue concentrations in small mammals are subject to: • Analytical measurement uncertainties (e.g., detection limits are typically elevated in tissues because of matrix interferences). • Considering the mobility of small mammals, whether tissues of trapped animals represent contaminant concentrations for organisms within investigation areas (versus offsite organisms). • Whether trapped small mammals (primarily deer mice and pocket mice) represent contaminant concentrations in all small mammals at investigation areas. Uncertainties associated with measured exposure include • Tissue effects concentrations based on potentially dissimilar species from those occurring onsite

Table 6-9. Qualitative Uncertainty Analysis for Terrestrial Assessment Endpoints. (7 Pages)

Assessment Endpoint	Attributes	Terrestrial Hypotheses	Weight	Conclusions
	Balanced gender ratios, juvenile recruitment, relative abundance from small mammal field studies	Relative population abundance, reproduction rates, equality of gender ratios and juvenile recruitment at waste/operational sites is not less than at references and does not decrease along an increasing contamination gradient	Med	Small mammal field studies were based on a snap shot in time and are subject to environmental vagaries (e.g., variable precipitation) affecting the community at the time of data collection. Another uncertainty is the extent to which inferences can be made from mammal field data for other middle trophic representatives (e.g., birds). Heavy nest predation by crows and ravens limited the amount of fledgling tissues that could be obtained for contaminant analyses and there are uncertainties in the applicability of extrapolating data from a few locations to the entire Hanford Reach. The following uncertainties also exist with regard to kingbird tissues: • Considering the mobility of adult kingbirds, uncertainty in whether invertebrate prey brought to nestlings (as represented by nestling crops) reflects contaminant concentrations for prey within investigation areas (versus offsite organisms). • Collected nestling tissue represents contaminant concentrations in all birds at riparian investigation areas.

Table 6-9. Qualitative Uncertainty Analysis for Terrestrial Assessment Endpoints. (7 Pages)

Assessment Endpoint	Attributes	Terrestrial Hypotheses	Weight	Conclusions
Carnivorous birds and mammals	Literature values for survival, growth or reproduction compared to modeled exposure	Dietary exposure modeled from waste/operational sites is not greater than toxicity reference values relative to exposure modeled from reference sites	Low	Use of literature toxicity reference values involves uncertainty in the extrapolation from test organisms to species occurring onsite based on: • Test conditions (e.g., method of contaminant delivery such as oral intubation or via gavage compared to ingestion of contaminated media onsite) • Bioavailability of contaminant (laboratory studies typically represent maximum bioavailability) relative to site-specific bioavailability • Laboratory toxicity studies are typically focused on a single contaminant whereas conditions in the field typically involve contaminant mixtures • Relatively short-term laboratory exposure compared to chronic exposure to contaminants in the field • Similarity in toxic response Uncertainties associated with modeled exposure include • Measuring media (tissue, soil) concentrations • Extent to which modeled intake for representative receptors reflects actual intake for organisms onsite. HIs for the badger are based primarily on thallium in the diet. The thallium TRV is highly uncertain because few toxicological data exist; it is therefore extremely conservative.

Low = hypothesis has low weight
Med = hypothesis has medium weight
High = hypothesis has high weight
NA = Not applicable to the endpoint in question given dearth of information linking measured tissue concentration to effects on that endpoint.

Table 6-10. Qualitative Uncertainty Analysis for Aquatic Near-Shore Assessment Endpoints. (6 Pages)

Assessment Endpoint	Attributes	Aquatic Hypotheses	Weight	Conclusions
Plants	Survival, growth from toxicity testing	Mean operational site survival and growth is not less than at reference sites and does not decrease along an increasing contamination gradient	High	An ecologically relevant test species, Pakchoi (member of the *Brassicaceae* family along with Hanford Site threatened and endangered plants such as persistantsepal yellowcress) was chosen to minimize uncertainty in extrapolating effects from sediment plant bioassays to Hanford Site flora. While these species are in the same family, they may have sensitivity differences to COPCs evaluated in the sediment bioassays .
Benthic macro-invertebrates	Literature values for survival, growth, or reproduction	Mean operational site water and sediment contaminant concentrations are not greater than benchmarks relative to reference sites	Low	Use of literature toxicity reference values involves uncertainty in the extrapolation from dose response in test organisms to species occurring onsite based on: • Test conditions (e.g., temperature, humidity) • Laboratory toxicity studies are typically focused on a single contaminant whereas conditions in the field typically involve contaminant mixtures • Bioavailability (laboratory studies typically represent maximum bioavailability whereas conditions in the field, such as weathering and sorption decrease bioavailability over time) • Relatively short-term laboratory exposure compared to chronic exposure to contaminants in the field • Similarity in toxic response

Table 6-10. Qualitative Uncertainty Analysis for Aquatic Near-Shore Assessment Endpoints. (6 Pages)

Assessment Endpoint	Attributes	Aquatic Hypotheses	Weight	Conclusions
	Diversity and abundance from rock baskets	Operational site species diversity and population abundance are not less than at reference sites and do not decrease along an increasing contamination gradient	Med	Aquatic macroinvertebrate diversity and abundance estimates are subject to the following uncertainties: • Whether invertebrates colonizing rock baskets are representative of the invertebrates living in the river bed of the Hanford Reach • Rock baskets also favor species associated with rocky substrates rather than burrowing species, which cannot colonize the rock surfaces. Burrowing species more typical of sandy substrates will be underrepresented. Rock baskets also reflect water column, rather than sediment-related, effects.
	Clam survival *in situ*	Mean operational site survival is not less than at reference sites and does not decrease along an increasing contamination gradient	Med	Clam tube survival may be subject to the following uncertainties: • Whether conditions within the tube are representative of conditions experienced by clams in the sediments and gravel/cobble of the river bed • Confounding effects such as "floating" tubes that may have caused excessive mortality due to starvation of the animals because these filter feeders were suspended too far above the river bed • Whether clam tube survival is affected by contaminants and/or by health of other clams in tube (e.g., a parasitized or diseased clam may affect other clams in tube)
	Clam histopathology	Operational site histopathological anomalies are not greater than at reference sites and do not increase along an increasing contamination gradient	High	Clam histopathology may be subject to the following uncertainties: • Observer biases in recording subjective levels of impairment (however, data recording/oversight by single observer and blind reading of slides helps minimize this potential uncertainty) • Histopathological endpoints recorded are diagnostic of tissue anomalies affecting fitness of organisms in the field.

Table 6-10. Qualitative Uncertainty Analysis for Aquatic Near-Shore Assessment Endpoints. (6 Pages)

Assessment Endpoint	Attributes	Aquatic Hypotheses	Weight	Conclusions
	Measured tissue concentrations	Mean operational site tissue contaminant concentrations are not greater than at reference sites and do not increase along an increasing contamination gradient	NA	Aquatic macroinvertebrate measured tissue concentrations are subject to the following uncertainties: • Analytical measurement uncertainties (e.g., detection limits are typically elevated in tissues because of matrix interferences). • Because of insufficient biomass at some investigation areas, additional invertebrates were collected (primarily crayfish) by hand picking them from the river bed. This introduces a bias towards chemical composition of invertebrate prey for higher trophic-level exposure (e.g., crayfish are high in copper). Uncertainties associated with measured exposure include Tissue effects concentrations based on potentially dissimilar species from those occurring onsite
	Survival and growth from toxicity testing	Mean operational site survival and growth is not less than at reference sites and does not decrease along an increasing contamination gradient	High	Uncertainties in *Hyalella* and *Ceriodaphnia* growth and survival include: • Relatively short-term laboratory exposure of test animals extrapolated to site invertebrates chronically exposed to contaminants • Extent to which *Hyalella* and *Ceriodaphnia* are representative of invertebrates in Hanford Reach sediments and water. • Potential laboratory methodological and record-keeping issues • Whether pore water sampling was representative of elevated contaminant concentrations. Specifically, whether Ceriodaphnia-assayed pore water represented primarily groundwater upwelling versus river water downwelling in the horizontal aquifer tubes. • Toxicity testing with laboratory species does not account for the adaptation of organisms to toxicant levels, which has been observed in some benthic invertebrates exposed to metals.

Table 6-10. Qualitative Uncertainty Analysis for Aquatic Near-Shore Assessment Endpoints. (6 Pages)

Assessment Endpoint	Attributes	Aquatic Hypotheses	Weight	Conclusions
Amphibians	Measured tissue concentrations	Mean operational site tissue contaminant concentrations are not greater than at reference sites and do not increase along an increasing contamination gradient	Med	Despite an extensive survey campaign for tadpoles, amphibian tissues were not widely available and thus there is uncertainty over true contaminant levels in amphibians of the Hanford Reach.
	Survival and growth based on toxicity testing	Mean operational site survival and growth is not less than at reference sites and does not decrease along an increasing contamination gradient	High	Uncertainties in *Xenopus* growth (malformations) and survival include: • Relatively short-term laboratory exposure of test animals extrapolated to amphibians chronically exposed to contaminants • Extent to which *Xenopus* are representative of amphibians exposed to Hanford Reach sediments and water • Whether pore water sampling was representative of elevated contaminant concentrations. Specifically, whether pore water represented primarily groundwater upwelling versus river water downwelling in the horizontal aquifer tubes. The biological significance of small yet statistically significant decreases in survival and growth at chromium and strontium plumes stations.

Table 6-10. Qualitative Uncertainty Analysis for Aquatic Near-Shore Assessment Endpoints. (6 Pages)

Assessment Endpoint	Attributes	Aquatic Hypotheses	Weight	Conclusions
Consumers (invertivores, piscivores)	Literature values for survival, growth, or reproduction compared to modeled exposure	Dietary exposure modeled from operational sites is not greater than toxicity reference values relative to exposure modeled from reference sites	Low	Use of literature toxicity reference values involves uncertainty in the extrapolation from test organisms to species occurring onsite based on: • Test conditions (e.g., method of contaminant delivery such as oral intubation or via gavage compared to ingestion of contaminated media onsite) • Bioavailability of contaminant (laboratory studies typically represent maximum bioavailability) relative to site-specific bioavailability • Laboratory toxicity studies are typically focused on a single contaminant whereas conditions in the field typically involve contaminant mixtures • Relatively short-term laboratory exposure compared to chronic exposure to contaminants in the field • Similarity in toxic response Uncertainties associated with modeled exposure include • Measuring media (tissue, soil) concentrations • Extent to which modeled intake for representative receptors reflects actual intake for organisms onsite.

Table 6-10. Qualitative Uncertainty Analysis for Aquatic Near-Shore Assessment Endpoints. (6 Pages)

Assessment Endpoint	Attributes	Aquatic Hypotheses	Weight	Conclusions
	Measured tissue concentrations	Mean operational site tissue contaminant concentrations are not greater than at reference sites and do not increase along an increasing contamination gradient	Med	Uncertainties associated with measured exposure include • Tissue effects concentrations based on potentially dissimilar species from those occurring onsite • Analytical measurement uncertainties (e.g., detection limits are typically elevated in tissues because of matrix interferences). Considering the mobility of fish, uncertainty in whether tissues of electroshocked animals represent contaminant concentrations for organisms within investigation areas (versus upstream/downstream organisms). • Whether harvested sculpin represent contaminant concentrations in all fish at aquatic investigation areas. Uncertainties associated with measured exposure include • Tissue effects concentrations based on potentially dissimilar species from those occurring onsite
	Fish histopathology	Operational site histopathological anomalies are not greater than at reference sites and do not increase along an increasing contamination gradient	High	Fish histopathology may be subject to the following uncertainties: • Observer biases in recording subjective levels of impairment (however, data recording/oversight by single observer and blind reading of slides helps minimize this potential uncertainty) • Whether histopathological endpoints recorded are diagnostic of tissue anomalies affecting fitness of fish in the field.

Low = hypothesis has low weight
Med = hypothesis has medium weight
High = hypothesis has high weight
NA = Not applicable to the endpoint in question given the dearth of information linking measured tissue concentration to effects on that endpoint.

7.0 REFERENCES

40 CFR 300.430, *Code of Federal Regulations* Title 40 "Protection of the Environment," Part 300, "National Oil and Hazardous Substances Pollution Contingency Plan," Subpart 430, "Remedial Investigation/Feasibility Study and Selection of Remedy."

43 CFR 11.23, *Code of Federal Regulations* Title 43 "Public Lands:Interior," Part 11 "Natural Resource Damage Assessments," Subpart 23, "Preassessment screen – General."

55 FR 8704, Promulgation of "CERCLA National Contingency Plan," March 8, 1990.

64 FR 61615, "Hanford Comprehensive Land-Use Plan Environmental Impact Statement, Hanford Site, Richland, Washington; Record of Decision," *Federal Register*, Vol. 64, No. 218, pp. 61615, November 12, 1999.

65 FR 37253, "Establishment of the Hanford Reach National Monument," *Federal Register*, Vol. 65, pp. 37253-37257, June 9, 2000.

American Cancer Society, 2005, Surveillance Research: Probability of Developing Invasive Cancers Over Selected Age Intervals, by Sex, US, 1999-2001, on-line at http://www.cancer.org/docroot/home/index.asp

ANL, 2006, *RESRAD Biota for Windows*, Version 1.21 (May 10, 2006), Environmental Science Division for Argonne National Laboratory for the U.S. Department of Energy, Argonne, Illinois (http://web.ead.anl.gov/resrad/home2/).

ANL/EAD-4, 2001, *User's Manual for RESRAD Version 6.0*, Environmental Assessment Division, Argonne National Laboratory, Chicago, Illinois.

ASTM D2488-00, *Standard Practice for Description and Identification of Soils (Visual – Manual Procedure)*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.

ASTM E1295-01, *Standard Guide for Conducting Three-Brood, Renewal Toxicity Tests with Ceriodaphnia dubia*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.

ASTM E1439-98, *Standard Guide for Conducting the Frog Embryo Teratogenesis Assay-Xenopus (FETAX)*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.

ASTM E1706-05, *Standard Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Fresh Water Invertebrates*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.

ASTM E2172-01, *Standard Guide for Conducting Laboratory Soil Toxicity Tests with the Nematode 'Caenorhabditis elegans*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.

ATSDR, 2005, *Toxicological Profile for Lead (Draft for Public Comment)*, U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry.

Baes, III, C. F., R. D. Sharp, A. L. Sjoreen, and R. W. Shor, 1984, *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides Through Agriculture*, Prepared for the U.S. Department of Energy by Oak Ridge National Laboratory, Oak Ridge, Tennessee.

BHI, 2004, *RESRAD Calculation Brief for 100 Area River Effluent Pipelines Supplemental Risk Assessment*, Calculation No. 0100X-CA-V0048, dated November 11, 2004, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2005, *RESRAD-BUILD Calculation Brief for 100 Area River Effluent Pipelines Supplemental Risk Assessment*, Calculation No. 0100X-CA-V0049, dated February 8, 2005, Bechtel Hanford, Inc., Richland, Washington.

BHI-00134, 1994, *100-D Island USRADS Radiological Surveys Preliminary Report - Phase II*, BHI-00134, Bechtel Hanford, Inc., Richland, Washington.

BHI-00538, 1996, *100 Area River Effluent Pipelines Characterization Report*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI-01141, 1998, *100 Area River Effluent Pipelines Risk Assessment*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI-01669, 2003, *A Preliminary Evaluation of Post-Remediation Protectiveness of Humans and the Environment at the 100-B/C Area*, Bechtel Hanford, Inc., Richland, Washington.

BHI-01724, 2005, *100-B/C Pilot Project Data Summary for 2003 and 2004*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI-01757, 2005, *DQO Summary Report for the 100 Area and 300 Area Component of the River Corridor Baseline Risk Assessment*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BJC/OR-133, 1998, *Empirical Models for the Uptake of Inorganic Chemicals by Plants*, Prepared for the U.S. Department of Energy, Office of Environmental Management, by Bechtel Jacobs Company LLC.

BNWL-243, 1966, *Soil Survey: Hanford Project in Benton County, Washington*, Hajek, B. F., Battelle Pacific Northwest Laboratories, Richland, Washington.

Books, G. G., 1985, "Avian Interaction with Mid-Columbia River Water Level Fluctuations," in *Northwest Science*, 59:304-312.

Chen, G. W. Zhu, G. M. Tian, G. D. Zhou, Y. M. Luo, and S. C. Wu, 2002, "Phytotoxicity of Dredged Sediment from Urban Canal as Land Application," *Environmental Pollution* 117:233-241.

Clements, W. H., 1994, Benthic Invertebrate Community Responses to Heavy Metals in the Upper Arkansas River Basin, Colorado," *Journal of the North American Benthological Society* 13: 30-44.

Clements, W. H., D. S. Cherry and J. Cairns, Jr., 1988, "Impact of Heavy Metals on Insect Communities in Streams: A Comparison of Observational and Experimental Results," *Canadian Journal of Fisheries and Aquatic Science* 45: 2017-2025.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 103, et seq.

Cowherd, C., G. Muleski, P. Engelhart, and D. Gillete, 1984, *Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination Sites*, prepared for the U.S. Environmental Protection Agency, Office of Health and Environmental Assessment, by Midwest Research Institute, Kansas City, Missouri.

CTUIR, 2005, *Response to Exposure Scenario Comments and Summary of Exposure Factors*, Memorandum from Stuart Harris, Director, CTUIR Department of Science & Engineering, to John Sands and John Morse, U.S. Department of Energy, and Donna Morgans, CH2MHill, August 18, 2005.

CVP-98-00006, 1999, *Cleanup Verification Package for the 116-C-1 Process Effluent Trench*, Bechtel Hanford, Inc, Richland, Washington.

Daubenmire, R., 1959, "A Canopy-Coverage Method of Vegetation Analysis," *Northwest Scientist* 33: 43-64.

DOE Order 5400.5, 1990. *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, Washington, D.C.

DOE/EH-231-076/0295r, 2003, *RCRA Facility Stabilization Initiative*, U.S. Department of Energy, Washington, D.C.

DOE/EIS-0119, 1992, *Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington*, U.S. Department of Energy, Washington, D.C.

DOE/EIS-0222-F, *Hanford Comprehensive Land-Use Plan Environmental Impact Statement*, September 1999, U.S. Department of Energy, Washington, D.C.

DOE/ORP-2000-19, 2005, *Annual Summary of the Integrated Disposal Facility Performance Assessment for 2004*, Rev. 4, U.S. Department of Energy, Office of River Protection, Richland, Washington.

DOE/RL-91-40, 1991, *Hanford Past-Practice Strategy*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-91-45, 1995, *Hanford Site Risk Assessment Methodology*, Rev. 3, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-92-24, 1995, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, Rev. 3, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-95-55, 1995, *Hanford Site Background: Evaluation of Existing Soil Radionuclide Data*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-95-111, 1998, *Corrective Measures Study for the 100-NR-1 and 100-NR-2 Operable Units*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-96-12, 1996, *Hanford Site Background: Part 2, Soil Background for Radionuclides*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-96-16, 1998, *Screening Assessment and Requirements for a Comprehensive Assessment: Columbia River Comprehensive Impact Assessment*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-96-17, 2005, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-96-61, 1997, *Hanford Site Background: Part 3, Groundwater Background*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-96-91, 1996, *Hanford Site Background: Part 3, Groundwater Background*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-97-02, 1997, *National Register of Historic Places Multiple Property Documentation Form - Historic, Archaeological and Traditional Cultural Properties of the Hanford Site, Washington*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-97-1047, 2002, *History of the Plutonium Production Facilities at the Hanford Site Historic District, 1943-1990,* U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2001-48, 2004, *Remedial Design Report/Remedial Action Work Plan for the 300 Area,* Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2001-54, 2001, *Ecological Evaluation of the Hanford 200 Areas – Phase 1: Compilation of Existing 200 Areas Ecological Data*, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2003-61, 2003, *100 Area and 300 Area Component of the River Corridor Baseline Risk Assessment: Basis and Assumptions on Project Scope*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2003-65, 2003, *Public Communication Plan for the 100 Area and 300 Area Component of the River Corridor Baseline Risk Assessment,* Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington

DOE/RL-2003-67, 2003, *Trustee Communication Plan for the River Corridor Baseline Risk Assessment Project*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2004-42, *Central Plateau Terrestrial Ecological Sampling and Analysis Plan: Phase I*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2004-37, 2005, *Risk Assessment Work Plan for the 100 Area and 300 Area Component of the RCBRA*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2005-22, 2005, *100-NR-2 Study Area Ecological Risk Assessment Sampling and Analysis Plan*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2005-30, *Central Plateau Terrestrial Ecological Sampling and Analysis Plan – Phase II*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2005-40, 2005, *100-B/C Pilot Project Risk Assessment Report*, Draft B, Vols. I-III, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2005-42, 2006, *100 Area and 300 Area Component of the RCBRA Sampling and Analysis Plan*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2005-49, 2005, *River Corridor Baseline Risk Assessment Stack Air Emissions Deposition Scoping Report*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2006-26, 2006, *Aquatic and Riparian Receptor Impact Information for the 100-NR-2 Groundwater Operable Unit*, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-STD-1153-2002, 2002, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota*, U.S. Department of Energy, Washington, D.C.

DOI, 1996, *Hanford Reach of the Columbia River: Comprehensive River Conservation Study and Environmental Impact Statement – Final*, 2 vols., U.S. Department of Interior, Washington, D.C.

Drummond, M. E., 1992, *The Future for Hanford: Uses and Cleanup, the Final Report of the Hanford Future Site Uses Working Group*, Richland, Washington.

DTS-SSPM-001, 2004, *Sampling Services Procedures Manual*, "Groundwater Sampling," SP: 3-1, Rev. 5, Duratek Technical Services, Richland, Washington.

Duberstein, C. A., 1997, "Riparian Stopover Habitat Selection by Spring Transient Landbirds of South-Central Washington," Masters thesis, Washington State University, Pullman, Washington.

Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

Ecology, 1992a, *Evaluation of Bioassay Organisms for Freshwater Sediment Toxicity Testing*, Publication 92-E-02, J. Bennet and J. Cubbage, Environmental Investigations Laboratory Services, Washington State Department of Ecology, Olympia, Washington.

Ecology, 1992b, *Statistical Guidance for Ecology Site Managers*, Publication No. 92-54, Washington State Department of Ecology, Olympia, Washington, August, 1992.

Ecology, 1994, *Natural Background Soil Metals Concentrations in Washington State*, Charles San Juan, Toxics Cleanup Program, Olympia, Washington, Publication 94-115, October 1994, Washington State Department of Ecology, Olympia, Washington.

Ecology, 2001, *Cleanup Levels and Risk Calculations Under the Model Toxics Control Act Cleanup Regulation, CLARC Version 3.1*, Publication No. 94-145 (updated November 2001), Washington State Department of Ecology, Olympia, Washington.

Eisler, R., 1986, *Polychlorinated Biphenyl Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review*, U.S. Fish and Wildlife Service Biological Report 85(1.7), 72 pp.

Eisler, R. and A. A. Belisle, 1996, *Planar PCB Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review*, U.S. Fish and Wildlife Service Biological Report 31, 83 pp.

Energy Northwest, 2004, *Cleanup Verification Package for the Hanford Generating Plant 100-N-4 Tile Field (SWMU #5); 100-N-1 Settling Pond (SWMU#6); 1908-NE Outfall (SWMU #7); 1716-NE Maintenance Garage (SWMU #8) and 100-N-52 Underground Storage Tank; 100-N-3 Maintenance Garage French Drain, 100-N-41 Gate House Septic Tank, and 100-N-45 Septic Tank (SWMU #9); 100-N-5 Bone Yard (SWMU #10); and 100-N-46 Underground Storage Tank. HGP-CVP-SWMUs 5, 6, 7, 8, 9, & 10*, Rev. 0, Energy Northwest, Inc., Richland, Washington.

EPA, 1989, *Risk Assessment Guidance for Superfund, Human Health Evaluation Manual, Part A, Interim Final*, OSWER Directive 9285.701A, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1991a, *Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites,* Office of Emergency and Remedial Response, OSWER Directive No. 9355.3-11. U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1991b, "Ecological Assessment of Superfund Sites: An Overview," *ECO Update*, Vol. 1, No. 2, Publication 9345.0-05I, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1991c, *Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors*, OSWER Directive 9285.6-03, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1991d, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, Supplemental Guidance Standard Default Exposure Factors*, OSWER Directive 9285.6-03, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1991e, *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*, EPA OWSER Directive 9355.0-30, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1991f, *Supplemental Guidance for Superfund Risk Assessments in Region 10*, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1991g, "The Role of the BTAGs in Ecological Assessment," *ECO Update*, Vol. 1, No. 1, Publication 9345.0-05I, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.

EPA, 1992a, "Briefing the BTAG: Initial Description of Setting, History, and Ecology of a Site," *ECO Update*, Vol. 1, No. 5, Publication 9345.0-05I, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1992b, "Developing a Work Scope for Ecological Assessments," *ECO Update*, Vol. 1, No. 4, Publication 9345.0-05I, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.

EPA, 1992c *Guidance on Risk Characterization for Risk Managers and Risk Assessors,* OSWER Directive 9285.7-17, Memorandum from F. Henry Habicht II, Deputy Administrator, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency.

EPA, 1992d, "The Role of the Natural Resource Trustees in the Superfund Process," *ECO Update*, Vol. 1, No. 3, Publication 9345.0-05I, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1994a, "Field Studies for Ecological Risk Assessment," *ECO Update*, Vol. 2, No. 3, Publication 9345.0-05I, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.

EPA, 1994b, *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities*, OSWER Directive 9355.4-12, Memorandum from Elliott P. Laws, Assistant Administrator, to Regional Administrators I-X, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1995a, *Declaration of the Record of Decision for 100-BC-1, 100-DR-1, 100-HR-1 Operable Units, USDOE Hanford Site, Benton County, Washington,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 1995b, *Guidance for Risk Characterization*, U.S. Environmental Protection Agency, Science Policy Council, Washington, D.C.

EPA, 1995c, *Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington,* September 1995, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 1996, *Record of Decision for the 300-FF-1 and 300-FF-5 Operable Units, Hanford Site, Benton County, Washington,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 1997, *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination*, Memorandum from Stephen D. Luftig, Director, Office of Emergency and Remedial Response, and Larry Weinstock, Acting Director, Office of Radiation and Indoor Air, to addressees, OSWER No. 9200.4-18, Washington, D.C.

EPA, 1998, *Toxicological Review of Hexavalent Chromium*, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1999a, *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*, OSWER 9200.1-23.P, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1999b, *Issuance of Final Guidance: Ecological Risk Assessment and Risk Management Principles for Superfund Sites* (Memorandum), OSWER Directive 9285.7-28P, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1999c, *Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3, Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 1999d, *Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 2000, *Interim Remedial Action Record of Decision for the 100-NR-1 TSD Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 2001a, "Lead; Identification of Dangerous Levels of Lead; Final Rule," 40 CFR Part 745, *Federal Register*/Vol. 66, No. 4/Friday, January 5, 2001/Rules and Regulations.

EPA, 2001b, *Physical and Chemical Properties*, August 6, 2001. On-line at http://epa-prgs.ornl.gov/download/superfund_master_properties_table.pdf

EPA, 2002a, *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites*, OSWER 9285.6-10, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 2002b, *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*, OSWER Directive 9355.4-24, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 2003a, *Draft Guidance for Developing Ecological Soil Screening Levels*, OSWER Directive 9285.7-55, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://www.epa.gov/ecotox/ecossl/pdf/ecossl_guidance_chapters.pdf

EPA, 2003b, *Human Health Toxicity Values in Superfund Risk Assessments*, Memorandum from Michael Cook, Director of the Office of Superfund Remediation and Technology Innovation, to Superfund National Policy Managers, OSWER 9285.7-53, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 2005, *Guidance for Developing Ecological Soil Screening Levels*, Attachment 1-3, *Evaluation of Dermal Contact and Inhalation Exposure Pathways for the Purposes of Setting EcoSSLs*, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://www.epa.gov/ecotox/ecossl/pdf/ecossl_attachment_1-3.pdf

EPA, 2006, Health Effects Assessment Summary Tables (HEAST), Radionuclides Table, Office of Radiation and Indoor Air, U.S. Environmental Protection Agency, Washington, D.C. On line at http://www.epa.gov/radiation/heast/

EPA, 2007, Integrated Risk Information System (IRIS), Office of Research and Development and National Center for Environmental Assessment, U.S. Environmental Protection Agency, Washington, D.C. Electronic database on line at http://www.epa.gov/iris/

EPA 120/R-07/001, 2007, *Framework for Metals Risk Assessment*, U.S. Environmental Protection Agency, Risk Assessment Forum, Washington,, D.C. Available at http://www.epa.gov/osa/metalsframework/

EPA-402-R-93-081, 1993, *External Exposure to Radionuclides in Air, Water, and Soil, Federal Guidance Report No. 12*, Oak Ridge National Laboratory, prepared for the Office of Radiation and Indoor Air, U.S. Environmental Protection Agency, Washington, D.C.

EPA 402/R-99/001, 1999, *Cancer Risk Coefficients for Environmental Exposure to Radionuclides, Federal Guidance Report No. 13*, Office of Radiation and Indoor Air, U.S. Environmental Protection Agency, Washington, D.C.

EPA 520/1-88-020, 1988, *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion factors for Inhalation, Submersion, and Ingestion, Federal Guidance Report No. 11*, Oak Ridge National Laboratory, prepared for the Office of Radiation Programs, U.S. Environmental Protection Agency, Washington, D.C.

EPA/530-R-05-006, 2005, *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Final*, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA/540-00-006, 2000, *Soil Screening Guidance for Radionuclides: Technical Background Document*, OSWER Directive 9355.4-16, Office of Emergency and Remedial Response, Washington, D.C.

EPA/540/1-89/001, 1989, *Risk Assessment Guidance for Superfund, Volume II,* "Environmental Evaluation Manual," U.S. Environmental Protection Agency, Washington, D.C.

EPA/540/1-89/002, 1989, *Risk Assessment Guidance for Superfund, Volume I,* "Human Health Evaluation Manual (Part A)," U.S. Environmental Protection Agency, Washington, D.C.

EPA 540/F-01/014, 2001, "The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments," *ECO Update*, Intermittent Bulletin, Publication 9345.0-14, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA/540-F-94-012, 1994, "Using Toxicity Tests in Ecological Risk Assessment," *ECO Update,* Vol. 2, No. 1, Publication 9345.0-05I, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA/540-F-94-013, 1994, "Catalog of Standard Toxicity Tests for Ecological Risk Assessment," *ECO Update,* Vol. 2, No. 2, Publication 9345.0-05I, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA/540-F-94-014, 1994, "Field Studies for Ecological Risk Assessment," *ECO Update*, Vol. 2, No. 3, Publication 9345.0-05I, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA/540-F-94-050, 1994, "Selecting and Using Reference Information in Superfund Ecological Risk Assessments," *ECO Update*, Vol. 2, No. 4, Publication 9345.0-10I, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA/540/F-95/037, 1996, "Ecological Significance and Selection of Candidate Assessment Endpoints," *ECO Update*, Vol. 3, No. 1, Publication 9345.0-05I, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.

EPA/540/F-95/038, 1996, "Ecotox Thresholds," *ECO Update*, Vol. 3, No. 2, Publication 9345.0-05I, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA/540/F-98-030, 1998, *Clarification to the 1994 Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities*, OSWER Directive 9200.4-27, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA/540-R-00-007, 2000, *Soil Screening Guidance for Radionuclides: User's Guide*, Office of Radiation and Indoor Air; Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA 540-R-02-002, 2001, *Risk Assessment Guidance for Superfund: Volume 3 – Part A, Process for Conducting Probabilistic Risk Assessment*, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA/540/R-95/128, 1996, *Soil Screening Guidance: Technical Background Document*, OSWER Directive 9355.4-17A, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA/540/R-96/018, 1996, *Soil Screening Guidance: User's Guide*, OSWER Directive 9355.4-23, U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, D.C.

EPA/540/R-97/006, 1997, *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (Interim Final)*, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA-540-R-97-036, 1997, *Health Effects Assessment Summary Tables, FY 1997 Update*, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA 540-R-98-025, 1998, *Superfund Accelerated Cleanup Model*, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.

EPA/540/R/99/005, 2004, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)* Final, OSWER Directive 9285.7-02EP, U.S. Environmental Protection Agency, Washington, D.C.

EPA-600-P00-002B, 2002, *Child-Specific Exposure Factors Handbook*, Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C.

EPA/600/P-95/002Fa, 1997, *Exposure Factors Handbook, Volume I: General Factors*, Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C.

EPA/600/P-95/002Fb, 1997, *Exposure Factors Handbook, Volume II: Food Ingestion Factors*, Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C.

EPA/600/P-95/002Fc, 1997, *Exposure Factors Handbook, Volume II: Activity Factors*, Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C.

EPA 600/R-00/096, 2000, *Volatilization Rates from Groundwater to Indoor Air, Phase II*, National Center for Environmental Assessment, Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C.

EPA/600/R-93/187a, 1993, *Wildlife Exposure Factors Handbook*, U.S. Environmental Protection Agency, Washington, D.C.

EPA/630/P-03/001F, 2005, *Guidelines for Carcinogen Risk Assessment*, Risk Assessment Forum, U.S. Environmental Protection Agency, Washington, D.C.

EPA 630-R-00-002, 2000, *Supplementary Guidance for Conducting Health Risk Assessment of Chemical Mixtures*, Risk Assessment Forum, U.S. Environmental Protection Agency, Washington, D.C.

EPA/630/R-03/003F, 2005, *Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens*, Risk Assessment Forum, U.S. Environmental Protection Agency, Washington, D.C.

EPA/630/R-95/002F, 1998, *Guidelines for Ecological Risk Assessment*, U.S. Environmental Protection Agency, Risk Assessment Forum, Washington, D.C. Available at: http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid/12460

EPA 910-R-02-006, 2002, *Columbia River Basin Fish Contaminant Survey 1996 – 1998*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, Ecology, and DOE, 2004, *Explanation of Significant Differences for the 300-FF-2 Operable Unit Record of Decision*, U.S. Environmental Protection Agency, Washington Sate Department of Ecology, and U.S. Department of Energy, Olympia, Washington.

EPA Richland Office, 2005, Draft Memorandum from Larry Gadbois, U.S. Environmental Protection Agency, Richland Project Office, to U.S. Department of Energy, Washington State Department of Energy, Washington State Department of Health, NRTC, CTUIR, and ERC.

Era, B. and D. Serdar, 2001, *Quality Assurance Project Plan for Reassessment of Toxicity Lake Roosevelt Sediments*, Washington State Department of Ecology, Olympia, Washington.

Exposure Scenarios Task Force, 2002, *Report of the Exposure Scenarios Task Force*, Sponsored by the Hanford Advisory Board, U.S. Department of Energy, U.S. Environmental Protection Agency, and Washington Department of Ecology. December 2002.

Fairbrother, A., 2003, "Lines of Evidence in Wildlife Risk Assessments," *Human and Ecological Risk Assessment* 9:1475-1491.

FDA, 1993, *Guidance Document for Arsenic in Shellfish*, Food and Drug Administration, Center for Food Safety and Applied Nutrition, Washington, D.C.

Gilbert, R. O., 1987, *Statistical Methods for Environmental Pollution Monitoring*, Von Nostrand Reinhold Company Inc., New York, New York.

Gilbert, R. O. and J. C. Simpson, 1990, "Statistical Sampling and Analysis Issues and Needs for Testing Attainment of Background-Based Cleanup Standards at Superfund Sites," in *Proceedings of the Workshop on Superfund* Hazardous *Waste: Statistical Issues in Characterizing a Site: Protocols, Tools, and Research Needs*, U.S. Environmental Protection Agency, Arlington, Virginia.

Gray, M. A., R. A. Cunjak, and K. R. Munkittrick, 2004, "Site Fidelity of Slimy Sculpin (*Cottus cognatus*): Insights from Stable Carbon and Nitrogen Analysis," *Canadian Journal of Fisheries and Aquatic Sciences,* NRC Research Press, National Research Council of Canada, Ottawa, Canada, 61: 1717-1722.

Hallock, L., 1998, *Herpetofauna of the Hanford Nuclear Reservation, Grant, Franklin, and Benton Counties, Washington,* unpublished report submitted to The Nature Conservancy of Seattle, Washington.

Harris, S., and B. L. Harper, 2004, *Exposure Scenario for the CTUIR Traditional Subsistence Lifeways,* dated September 15, 2004, Department of Natural Resources, Pendleton, Oregon.

Hill, J. and G. D. Grossman, 1987, "Home Range Estimates for Three North American Stream Fishes," *Copeia,* ASIH Publications, Lawrence, Kansas, pp. 376-380.

HNF-7644, 2001, *Retrieval Performance Evaluation for Single-Shell Tanks S-112 and S-102,* Rev. 0, Fluor Hanford, Inc., Richland, Washington.

Hoover, J. D., "RE: 'Background' perspective on the background documents," CCN 134185, email communication to S. G. Weiss, Washington Closure Hanford, from J. D. Hoover, Fluor Hanford, Inc., dated May 10, 2007.

Hull, R. N. and S. Swanson, 2006, "Sequential Analysis of Lines of Evidence -- An Advanced Weight-of-Evidence Approach for Ecological Risk Assessment," *Integrated Environmental Assessment and Management* 2:302-311.

ICRP, 1977, *Recommendations of the International Commission on Radiological Protection,* ICRP Publication 26, Annals of the ICRP, Volume 1, No. 3, Pergamon Press, New York.

Institute of Medicine, 2001, *Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc*, Institute of Medicine, Washington, D.C.

Jarvinen, A. W. and G. T. Ankley, 1999, *Linkage of Effects to Tissue Residues: Development of a Comprehensive Database for Aquatic Organisms Exposed to Inorganic and Organic Chemicals*, Society of Environmental Toxicology and Chemistry (SETAC), Pensacola, Florida, 364 pp.

Kiffney, P. M. and W. H. Clements, 1994, "Effects of Heavy Metals on a Macroinvertebrate Assemblage from a Rocky Mountain Stream in Experimental Microcosms," *Journal of the North American Benthological Society* 13: 511-523.

Klaassen, C. D. (ed.), 2001, *Casarett and Doull's Toxicology: The Basic Science of Poisons, Sixth Edition*, McGraw-Hill Companies, Inc., New York, New York.

LANL, 2005, Ecorisk Database (Release 2.2), September 2005, Los Alamos National Laboratory, RRES-RS Project, Los Alamos, New Mexico.

Majewski, M. S., S. C. Kahle, J. C. Ebbert, and E. G. Josberger, 2003, *Concentrations and Distributions of Slag-Related Trace Elements and Mercury in Fine-Grained Beach and Bed Sediments of Lake Roosevelt, Washington, April – May 2001,* Water-Resources Investigations Report 03-4170, U.S. Geological Survey, Washington Water Science Center, Tacoma, Washington.

Maret, T. R., D .J. Cain, D. E. MacCoy, and T. M. Short, 2003, "Response of Benthic Invertebrate Assemblages to Metal Exposure and Bioaccumulation Associated with Hard-Rock Mining in Northwestern Streams, USA," *Journal of the North American Benthological Society* 22: 598-620.

Markwiese, J. T., R. T. Ryti, M. M. Hooten, D. I. Michael, and I. Hlohowskyj, 2001, "Toxicity Bioassays for Ecological Risk Assessment in Arid and Semiarid Ecosystems," *Reviews of Environmental Contamination and Toxicology* 168:43-98.

McCleave, J. D., 1964, "Movement and Population of the Mottled Sculpin (*Cottus bairdi*) in a Small Montana Stream," *Copeia,* ASIH Publications, Lawrence, Kansas, pp. 506-512.

Menzie, C., M. H. Henning, J. Cura, K. Finkelstein, J. Gentile, J. Maughan, D. Mitchell, S. Petron, B. Potocki, S. Svirsky, and P. Tyler, 1996, "A Weight-of-Evidence Approach for Evaluating Ecological Risks: Massachusetts Weight-of-Evidence Workshop," in *Human and Ecological Risk Assessment* 2:277-304. Available on the Internet at http://www.state.ma.us/dep/ors/files/weightev.pdf .

Morgan, C. R. and N. H. Ringler, 1992, "Experimental Manipulation of Sculpin (*Cottus cognatus*) Populations in a Small Stream," *Journal of Freshwater Ecology* 7: 227-232 (ISSN 0270-5060), Oikos Publishers, Inc., La Crosse, Wisconsin.

National Gardening Association, Inc., 1987, *National Gardening Survey: 1986-1987*, National Gardening Association, Inc., Burlington, Vermont.

Ng, Y. C., C. S. Colsher, and S. E. Thompson, 1982, *Transfer Coefficients for Assessing the Dose from Radionuclides in Meat and Eggs*, NUREG/CR-2976, UCID-19464, Lawrence Livermore National Laboratory, Livermore, California.

NLM, 2007, Hazardous Substances Data Base (HSDB), Part of the National Library of Medicine's Toxicology Data Network, National Institutes of Health. Electronic database available on line at http://toxnet.nlm.nih.gov/

NRC, 2004, *Fact Sheet: Biological Effects of Radiation*, U.S. Nuclear Regulatory Commission, Office of Public Affairs, Washington, D.C.

NUREG/CR-5512-V1, 1992, *Residual Radioactive Contamination from Decommissioning – Technical Basis for Translating Contamination Levels to Annual Total Effective Dose Equivalent: Final Report*, Pacific Northwest Laboratory, Richland, Washington.

PNL-2465, 1978, *Darkling Beetle Populations (Tenebrionidae) of the Hanford Site in Southcentral Washington,* Pacific Northwest Laboratory, Richland, Washington.

PNL-2774, 1979, *Characterization of the Hanford 300 Area Burial Grounds: Task IV – Biological Transport,* Pacific Northwest Laboratory, Richland, Washington.

PNL-4140, 1982, *Habitat Requirements and Burrowing Depths of Rodents in Relation to Shallow Waste Burial Sites,* Pacific Northwest Laboratory, Richland, Washington.

PNL-6415, 2005, *Hanford Site National Environmental Policy Act (NEPA) Characterization,* Rev. 17, Pacific Northwest National Laboratory, Richland, Washington.

PNL-8942, 1993, *Habitat Types on the Hanford Site: Wildlife and Plant Species of Concern,* Pacific Northwest Laboratory, Richland, Washington.

PNL-9394, 1994, *Ecotoxicity Literature Review of Selected Hanford Site Contaminants*, Pacific Northwest Laboratory, Richland, Washington.

PNL-10285, 1995, *Estimated Recharge Rates at the Hanford Site*, Pacific Northwest Laboratory, Richland, Washington.

PNNL, 2005, *Aquatic and Riparian Receptor Impact Information for the 100-NR-2 Groundwater Operable Unit*, Pacific Northwest National Laboratory, Richland, Washington. (URL: http://www.washingtonclosure.com/projects/EndState/docs/100-NR-2_Report.pdf)

PNNL-12088, 1999, *Hanford Site Environmental Report for Calendar Year 1998 (Hanford Site 1998 Environmental Report)*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-11800, 1998, *Composite Analysis for Low-Level Waste Disposal in the 200 Area Plateau of the Hanford Site*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13080, 2000, *Hanford Site Groundwater Monitoring: Setting, Sources, and Methods*, Hartman, M. J., (ed.) Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13230, 2000, *Hanford Site Environmental Report for Calendar Year 1999 (Including Some Historical and Early 2000 Information)*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13487, 2001, *Hanford Site Environmental Report 2000 – App. 1: Hanford Site Environmental Surveillance Data Report – App. 2: Hanford Site Near-Facility Environmental Monitoring Data Report + Summary*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13688, 2001, *Vascular Plants of the Hanford Site*, Pacific Northwest National Laboratory, Richland, Washington. URL: http://www.hanford.gov/doe/history/docs/rl-97-1047/index.pdf.

PNNL-13840, 2002, *2001 Columbia River Recreation Survey-Implications for the Hanford Site Integrated Assessment*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13910, 2002, *Hanford Site Environmental Report 2001 – App. 1: Environmental Surveillance Data Report – App. 2: Near-Facility Environmental Monitoring Data Report – Sum.: Summary of the Hanford Site Environmental Report – for Calendar Year 2001*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-14295, 2003, *Hanford Site Environmental Report for Calendar Year 2002: Summary + App. 1, Hanford Site Environmental Surveillance Data Report: App. 2, Hanford Site Near-Facility Environmental Monitoring Data Report*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-14516, 2004, *FY2003 Synthesis of Ecological Data Collected in the Riparian and Riverine Environments of the Hanford Reach*, Downs, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-14687, 2004, *Hanford Site Environmental Monitoring Report for Calendar Year 2003*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-15670, *Hanford Site Groundwater Monitoring for Fiscal Year 2005*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-15892, 2006, *Hanford Site Environmental Report for Calendar Year 2005*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-SA-41467, 2004, *Literature Review of Environmental Documents in Support of the 100 and 300 Area River Corridor Baseline Risk Assessment*, Rev. 0, Pacific Northwest National Laboratory, Richland, Washington.

Presidential Proclamation 7319, "Establishment of the Hanford Reach National Monument," June 9, 2000.

National Defense Authorization Act for Fiscal Year 1997, Public Law 104-201, Section 3153.

National Environmental Policy Act of 1969, Public Law 91-190.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq.

Revised Code of Washington 36.70A, "Growth management - planning by selected counties and cites."

RHO-SA-211, 1981, *Intrusion of Radioactive Waste Burial Sites by the Great Basin Pocket Mouse,* Rockwell Hanford Operations, Richland, Washington.

Richmond, M. C. and W. A. Perkins, 1998, *MASS1 Modular Aquatic Simulation System ID, A One-Dimensional Hydrodynamic and Water Quality Model for River Systems*, Draft Report, Pacific Northwest National Laboratory, Richland, Washington.

Rickard, W. H., 1964, "Bird Surveys in Cottonwood-Willow Communities in Winter," in *Murrelet* 45:22-25.

Rickard, W. H., and B. J. Rickard, 1972, "A Comparison of Winter Bird Populations after a Decade," in *Murrelet* 53(3):42-47.

Rogers, L. E. and R. E. Fitzner, 1980, "Characterization of Darkling Beetles Inhabiting Radioecology Study Areas at the Hanford Site in Southcentral Washington," in *Northwest Science*, Vol. 54, pp. 202-206.

Rogers, L. E., N. E. Woodley, J. K. Sheldon, and P. A. Beedlow, 1988, "Diets of Darkling Beetles (Coleoptera: Tenebrionidae) Within A Shrub-Steppe Ecosystem," in *Annals of the Entomological Society of America*, Vol. 81, pp. 782-791.

Roy, R., M. Snyder, S. Krest, R. Hill, N. Rein, and J. Campbell, 1998, *Report of the Preliminary Findings of the Level III Preacquisition Environmental Contaminants Survey for the Hanford North (Wahluke) Slope and the Arid Land Ecology Reserve, Hanford Reservation, Washington*, U.S. Fish and Wildlife Service, Portland, Oregon.

Schonwald, S., 2001, *Medical Toxicology: A Synopsis and Study Guide*, Lippincott Williams & Wilkins, Philadelphia, Pennsylvania.

SRC, 2007, Interactive PhysProp Database Demo, Syracuse Research Corporation. On-line at http://www.syrres.com/esc/physdemo.htm

Superfund Amendments and Reauthorization Act of 1986, Public Law 99-499.

Suter, G. W. II, R. A. Efroymson, B. E. Sample, and D. S. Jones, 2000, *Ecological Risk Assessment for Contaminated Sites*, Lewis Publishers, Boca Raton, Florida, pp. 438.

UNI-946, 1978, *Radiological Characterization of the Retired 100 Areas*, United Nuclear Industries, Inc. Richland, Washington.

UNI-3262, 1986, *River Discharge Lines Characterization Report,* UNC Nuclear Industries, Inc., Richland, Washington.

Visual Sampling Plan Software, Version 4.0a, Release Date 07/13/2005, Battelle Memorial Institute, Pacific Northwest National Laboratory, Richland, Washington.

WAC 173-340, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*, as amended.

WAC-173-340-900, "Tables," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-340-7490, "Terrestrial Ecological Evaluation Procedures," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-340-740(6)(d), "Unrestricted Land Use Cleanup Standards," *Washington Administrative Code*, as amended.

Wang, Y.-Y., B.M. Biwer, and C. Yu, 1993, *A Compilation of Radionuclide Transfer Factors for the Plant, Meat, Milk, and Aquatic Food Pathways and the Suggested Default Values for the RESRAD Code*, Argonne National Laboratory, Environmental Assessment and Information Sciences Division, Argonne, Illinois.

Ward, G.. M. and J. E. Johnson, 1986, "Validity of the Term Transfer Coefficient," *Health Physics*, Vol. 50, No. 3, pp. 411-414, 1986.

WCH -85, 2006, *100 Area and 300 Area Component of the RCBRA Fall 2005 Data Compilation,* Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH-91, 2006, *Columbia River Component Data Evaluation Summary Report*, Draft A, Washington Closure Hanford, Richland, Washington.

WCH-139, 2006, *100 Area and 300 Area Component of the River Corridor Baseline Risk Assessment Spring 2006 Data Compilation*, Rev. 0, Washington Closure Hanford, Richland, Washington.

WDFW, 2003, *Washington Department of Fish and Wildlife's Priority Habitat and Species Management Recommendations, Vol IV: Birds – Sage Sparrow, Amphispiza belli*, Washington Department of Fish and Wildlife, Olympia, Washington. Available at: http://wdfw.wa.gov/hab/phs/vol4/sage_sparrow.pdf

WDOH/320-015, 1997, *Hanford Guidance for Radiological Cleanup*, Rev. 1, Washington State Department of Health, Olympia, Washington.

WDOH/ERS-96-1101, 1996, *100-D Island Radiological Survey Report*, Publication WDOH/ERS-96-1101, Washington State Department of Health, Office of Radiation Protection, Olympia, Washington.

WHC-EP-087, *Estimates of Solid Waste Buried in 100 Area Burial Grounds*, Westinghouse Hanford Company, Richland, Washington.

WHC-EP-0601, 1992, *A Synthesis of Ecological Data from the 100 Areas of the Hanford Site*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC-EP-0620, 1993, *100 Areas CERCLA Ecological Investigations*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC-MR-0246, 1991, *Characterization and Use of Soil and Groundwater Background for the Hanford Site*, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-TI-278, 1994, *Columbia River Effluent Pipeline Survey*, Rev. 0, Westinghouse Hanford Company, Richland, Washington

WHC-SP-0480, 1989, *Characterization of Radionuclide Concentrations Along the N-Springs Shoreline for 1988*, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

INVESTIGATION AREA LOCATIONS FOR THE 100 AREA AND 300 AREA COMPONENT OF THE RCBRA

(See attached CD for complete file)

APPENDIX B

DATABASE INTERFACE

(See attached CD for complete file)

APPENDIX C

MULTI-INCREMENT SAMPLING (MIS) PERFORMANCE ASSESSMENT

(See attached CD for complete file)

APPENDIX D

MEETING NOTES FOR THE 100 AREA AND 300 AREA COMPONENT OF THE RCBRA RISK ASSESSMENT WORKSHOPS

(See attached CD for complete file)

APPENDIX E

ADDITIONAL INFORMATION ON REFERENCE SITE SELECTION

(See attached CD for complete file)

APPENDIX F

DATA ANALYSIS

(See attached CD for complete file)

APPENDIX G

HUMAN HEALTH RISK ASSESSMENT

(See attached CD for complete file)

APPENDIX H

ECOLOGICAL RISK ASSESSMENT

(See attached CD for complete file)